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The
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No. 1. JANUARY, 1899. Vol. XIII.

THE PRESIDENT'S OPENING ADDRESS, SESSION 1898–99.*

In opening the Session, I propose to refer to the progress of geographical work since we last met, and to dwell more especially on the outlook as regards the prospects of antarctic exploration; for that must be the point of chief interest, not only to geographers, but to men of science generally, until the work is done.

I would first, however, congratulate the Society on the unusually large increase to our numbers which has just been announced, and which must be looked upon as an auspicious commencement of our Session.

In Africa there has been considerable activity among travellers, chiefly with a view to connecting earlier work, and making supplementary surveys; although the diligence of our explorers has, in some cases, led to new discoveries. Major Gibbons is continuing his exploring work in the region of the upper Zambezi; and Mr. L. A. Wallace has made a complete circuit of Lake Rukwa, and has ascertained the character of its drainage. Mr. J. E. S. Moore, assisted, I believe, by grants from the Royal Society, has already investigated the remarkable fauna of Lake Tanganyika; and his researches will throw light on the changes which have taken place in the land conformation of Central Africa. This observant traveller is now arranging to undertake the further investigation of Lake Tanganyika and the region around its shores, as well as the exploration of the almost unknown stretch between the north end of Lake Tanganyika and Lake Albert Edward. The officers in Uganda have continued to give their attention to the geography of that region. We have received a report from Lieut. Claud Hobart, of the Grenadier Guards, respecting the discovery of a lake by him to the west of the Victoria Nyanza. Captains Kirkpatrick and McLoughlin have examined Lake Kioja, and ascertained that it extends much further to the east than is shown on the maps; while Major Macdonald himself, using the Society's instruments, is making an important survey from Uganda to Lake Rudolf. He has already reported that he has ascertained the nature of the drainage from Mount Elgon towards the Nile. Turning to Eastern Africa, we have been glad to hear of the safe return of Lord Delamere from his adventurous sporting journey in and beyond Somaliland; and we regret that the exploring zeal of such promising young travellers as Cavendish and Carnegie should have been checked for political reasons. Hence the valley of the Sobat, and the region between Lake Rudolf and the Nile, still remain to be discovered. Captain Wellby is now on his way to the country on the south-west of Abyssinia.

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* Read at the Royal Geographical Society, November 14, 1898.

French explorers have been active in various parts of Africa, but not always in the pursuit of pure geography. M. Foa has executed a large amount of valuable surveying work in the region of the lakes and in the eastern part of the Congo territory; and M. Foureau has been indefatigable in his efforts to clear up the geography of the less-known parts of the Sahara. It was in November, 1897, that M. Gentil reached Lake Chad; but it is only recently that we have received any details of his topographical work, chiefly on the river Shari. On the Mobangi (or Ubangi), M. Liotard has extended the exploration of this great tributary of the Congo, which was commenced by our Gold Medallist, Mr. Grenfell. Under his auspices, Major Marchand's expedition was sent to the upper Nile. No detailed account of the results of Major Marchand's work has yet reached us. He appears to have ascended the Mbomu, an affluent of the Mobangi, and thence to have made his way to the Nile basin, launched his steel boats on the Sue, and, descending that river into the Bhar-el-Ghazal, arrived at Fashoda this summer. Scarcely any of this route is over new ground, as previous explorers had traversed most parts of the Egyptian province of Bhar-el-Ghazal, and extended their journeys as far as the Welle river. The interesting part of Major Marchand's journey will be his descent of the Sue tributary of the Bhar-el-Ghazal, which to a large extent is new.

The Bhar-el-Ghazal province was first explored by Schweinfurth, who gave a detailed and most interesting account of the tribes inhabiting that region, and of his visit to the Niam-niam country. Then followed the expulsion of the slave-traders, and the establishment of the Bhar-el-Ghazal as an Egyptian province; while Fashoda has been a station of the Egyptian Government for thirty years. The Bhar-el-Ghazal has been described in the works of Gessi Pasha and of Junker, and we have published two maps to illustrate the paper of Dr. Junker and the letters of Lupton Bey. It is not, therefore, necessary to issue another map of the Egyptian province of Bhar-el-Ghazal in the absence of fresh material.

It is interesting to remember that only forty years ago, all this vast region of the valley of the upper Nile was unknown. Its discovery was due to the advocacy and encouragement and to the large expenditure of the Royal Geographical Society, without which Speke, Grant, Petherick, and Baker could not have achieved their great successes in this region. To this Society belongs the credit of having brought the equatorial lakes and the upper Nile to the knowledge of the civilized world.

Turning from Africa to Asia, I have to report that Captain Deasy, who has gone through a course of study, and has been supplied with instruments by the Society, was at Khotan in May, when we last heard of him, having fixed the longitudes of Yarkand and Khotan by chronometer. Mr. Savage Landor returned from his attempt to reach Lhasa by the Tsanpu valley last spring; and he has already published the narrative of his sufferings at the hands of the Lamas, who appear to have become quite savage in their determination to exclude foreigners from their country. This was not always the case. Nothing could exceed the courtesy and hospitality with which the monk Desideri, who adopted the same route as Mr. Savage Landor, was received by the Lamas in 1719, and the envoys of Warren Hastings received a similar welcome in 1775 and 1783. Clearly the Tibetans have degenerated, owing to causes arising from their isolation, during the intervening century. Mr. Savage Landor has raised a question whether there is a stream connecting the Mansarowar and Rakastal lakes, which is shown on the Lama map, and on that drawn by Mr. John Walker for General Cunningham's work on Ladak in 1854. The subject is discussed by Captain Henry Strachey in the *Journal* of the Asiatic Society of Bengal, who saw and crossed the stream in question, while his brother Sir Richard also saw it, where it leaves the Mansarowar lake. There can be no question, however, that Mr. Landor was the first Englishman, though not the first European, to penetrate into the valley of the Tsanpu by way of the Marian-la. The same route was travelled over in 1719 by Desideri, who reached Lhasa without hindrance. One of the most interesting pieces of geographical work that remains to be achieved in Central Asia, is the detailed examination of the great chain of mountains bounding the Tsanpu valley on the north. I have called it the *northern Himalayan chain;* Mr. Brian Hodgson gave it the name of *Nyen-chen-tangla*, and Mr. Trelawney Saunders suggested the *Gangri* range; but no name has been adopted, and the mountains are practically unknown. It would certainly be most imprudent to approach them from the Tsanpu valley in the track of Mr. Savage Landor, but I do not think that they would be found to be altogether inaccessible on the northern side. Fortunately, we have several young aspirants for fame to be acquired by Central Asian travel and exploration.

From the islands of the Eastern Archipelago and the Pacific we anticipate fresh and interesting information during the coming session.

Three young American explorers, Dr. Hiller, Mr. Harrison, and Mr. Furness, have returned after having pushed far into the dense forests of Northern Borneo; our old friend and associate Dr. Forbes has set out to explore Sokotra; Mr. Andrews will tell us of his sojourn on the virgin Christmas island; and Mr. Christian has been resident for some time in the Caroline islands. We have had no account of that little-known group since Admiral Cyprian Bridge's paper was read in April, 1886—a memorable occasion, because it was the first time that lantern slides were ever exhibited in this hall.

From North America we shall have accounts of the search for Mounts Hooker and Brown in the Canadian Rocky mountains, and of the ascent of the almost unknown Thaam river from Hudson's bay by the Rev. J. Lofthouse. In South America, Sir Martin Conway has been undertaking the ascent of the two loftiest peaks in the Bolivian Andes, Mounts Illimani and Illampu; and I have some hopes of a paper on the Argentine-Chilian boundary question, by Don Carlos Pellegrini, the former President of the Argentine Confederation. But as a result of the study of accumulated stores of South American exploration and research, I would particularly call attention to Colonel Church's admirable address in opening Section E of the British Association at Bristol this year. The subject of which Colonel Church treats is the evidence of the existence of an ancient Pampean sea, covering all the plain country of the present Argentine Republic, and of a great Mojos lake to the northward. Colonel Church's address is an example of the uses to be made of the work of explorers by an able and thoughtful geographical student. The collected facts are well arranged, the arguments are clear and convincing, and the conclusions are alike interesting and important from the point of view of the evolution of physical geography. Our associate, however, is himself an explorer as well as a student.

Oceanography is receiving its share of attention. The Prince of Monaco read to us, last session, a most fascinating paper on the results of his comprehensive researches in the ocean depths; and this season he has been at work, in his yacht, in the northern seas. It was with very great pleasure that I received a letter from the Swedish Minister last April, announcing that our Admiralty has been asked to join in the excellent scheme proposed by the Swedish Hydrographic Commission. It consists of the organization of a common plan for research into the chemical, physical, and biological conditions of the water in the North Atlantic, North Sea, and Baltic, especially with regard to fishing interests, to be undertaken jointly by Great Britain, Norway, Denmark, Sweden, and Germany. A resolution was passed at the International Geographical Congress in 1895 approving of the scheme; and Prof. Pettersson has explained that a knowledge of the currents in the upper layers of the sea, and of the food they contain, is necessary for an intelligent organization of the fisheries, so that the undertaking would be one of practical utility. I sincerely trust that our Government will agree to take part in so excellent and useful a project. Under the leadership of Mr. George Murray, of the Natural History Museum, and partly aided by our Society, an expedition has started for the exploration of the intermediate depths of the ocean between England and the Canaries. Soundings and observations of the bottom will also be taken.

The Germans have taken a very noble initiative with regard to oceanography. When Prof. Carl Chun, of Leipzig, proposed the equipment of a German deep-sea scientific expedition, he received the liberal support of an enlightened government. The German parliament voted a sum of £15,000, and there will be additional grants for publishing the results. A steamer of the Hamburg-American line, the *Valdivia*, of 2600 tons, was chartered and fitted up in all respects like the *Challenger*, with a staff of eleven scientific men under Prof. Chun. The Government pays the salaries of these men of science, and insures their lives. The expedition sailed from Hamburg on August 2 last, and proceeded to Granton with Sir John Murray on board, whence they had an opportunity of visiting the *Challenger* Office in Edinburgh, and inspecting the interesting collection deposited there. The *Valdivia* then went round the north of Scotland, and proceeded to the Canary islands, whence the expedition is making its way along the west coast of Africa to the Cape. It will then examine the Agulhas bank, go south to the edge of the antarctic ice, and in a cruise of nine months explore the depths of the Indian Ocean and the Red Sea, returning by the Suez canal. The German expedition is ably directed and admirably equipped, and is sure to yield excellent results, alike creditable to the nation and its government, and to the workers themselves.

In turning our view to the northern regions, we have first to congratulate Dr. Thoroddsen on the completion of his exhaustive Icelandic researches, which have extended over many years. I am glad to be able to announce that he has undertaken to furnish the Society with a complete *resumé* of the results of his labours, and with the materials for a new map of Iceland. The most valuable recent arctic work is comprised in the two handsome volumes recording the results of Dr. Erich von Drygalski's Greenland expedition. Its publication certainly reflects the highest credit on the Berlin Geographical Society. Dr. Drygalski has made a series of very important observations on the inland ice of Greenland, on its movement, on its structure, and on its formation of icebergs, as well as on the biology and botany of the Greenland coast region. I am glad to hear from Dr. Nansen that he is now beginning to print the first parts of the scientific results of his memorable expedition.

Dr. A. G. Nathorst, of Stockholm, has conducted a Swedish scientific expedition to Spitsbergen this summer, on board the Norwegian whaler

Antarctic. He first made a survey and a very thorough examination of Bear island, and also of Bell sound. Dr. Nathorst then penetrated to the east side of Spitsbergen, where he surveyed and mapped Wiche's island. As this island was discovered and named by Captain Edge in 1617, and rediscovered by the English yachtsman Birkbeck in 1864, I am at a loss to understand by what right the name has been changed to King Charles Land, because Von Heuglin sighted it in 1870, and improperly made the alteration. These changes of original names are unjust, confusing, and undesirable from every point of view. The German authorities have attempted to change the names of New Britain and New Ireland, given by their discoverers Captains Dampier and Carteret, early in the last century, to Neu Pommern and Neu Mecklenburg. But I was glad to find, when I visited Berlin this summer, that these unjustifiable changes are not countenanced by sensible Germans, and that "New Britain" and "New Ireland" are still printed in large letters over the cases containing curiosities from those islands in the Berlin Ethnological Museum; neither is the change admitted by our hydrographer, which probably settles the question—our charts being so universally used. Returning to Dr. Nathorst, he passed White island, reached a latitude of 81° 14′ N., and circumnavigated Spitsbergen. The scientific results of his expedition are numerous and valuable, and I am happy to announce that Dr. Nathorst will communicate a paper to the Society, describing those results, in the course of the session. A German expedition under Herr Theodor Lerner, with Captain Rüdiger in command of the vessel, has also been on the east coast of Spitsbergen this summer, and reached a latitude 81° 32′ N.

There are now four expeditions wintering in the arctic regions. The first, in point of time, is the balloon expedition led by M. Andrée, for the safety of which there is now grave reason for anxiety. Dr. Nansen and I believed and hoped that M. Andrée would have reached Mr. Harmsworth's stores in Franz Josef Land, but Mr. Wellman has dispelled that hope. M. Stradling has conducted a search at the mouths of the Lena and Indigirka, and has visited the New Siberia islands, without finding any sign of Andrée and his gallant companions. I still cling to the hope that they may have reached the east coast of Greenland, and may yet be saved.

The three other expeditions, though two of them contemplate useful scientific work, all have the north pole as their chief aim. I have several times repeated that the Council of this Society has always consistently maintained that merely to reach the poles, or to attain a higher latitude than some one else, were objects unworthy of support or encouragement. In our view, the objects of arctic and antarctic exploration are to secure valuable results in all branches of science, and particularly in geographical science. In this view we have the concurrence of Dr. Nansen, and of the late Lieut. Weyprecht, who spoke very strongly on the subject. Much arctic geographical work remains to be achieved, including the discovery of the northern side of Greenland and its off-lying islands; the examination of the palæocrystic sea from Aldrich's furthest to Prince Patrick island; the discovery of the unknown region between Prince Patrick island and Siberia; and the exploration of Sannikoff Land, as proposed by Baron Toll.

The Wellman expedition to Franz Josef Land has for its avowed object, a struggle to reach the pole, or at least to get beyond Nansen's furthest—"to beat the best record," as they call it. Mr. Wellman has three companions—Messrs. Horlan, Waller, and Hoffman, and he chartered the *Fridtjof*, an excellent little vessel for the ice, to take his party to Franz Josef Land, and put them on shore. He has seventy-five dogs, and his plan is for fifty of the dogs each to drag a small sledge weighing 100 lbs., consisting of a copper tube with runners. Mr. Wellman's party landed last June, and took one of Mr. Harmsworth's houses from Cape Flora to Cape Tegethoff, where they set it up as a base. Mr. Wellman intended to go as far north as he could this season, winter in a stone hut, and again push northwards in the season of 1899. The *Fridtjof* was to return, and take his party back in the autumn of that year.

The two expeditions up Smith sound are of a more serious character, and are likely to do good work, if they succeed in reaching a suitable base for their operations. But the navigation of Smith sound, and of the channels leading northward from it, depends upon the season, and may be impracticable. It is to be hoped, however, that this serious difficulty on the threshold may be overcome.

Lieut. Peary was generously presented with a suitable vessel, the *Windward*, by Mr. Harmsworth, and he left New York on July 2. A vessel called the *Hope* had been sent forward to fill up the *Windward* with supplies, near the entrance of Smith sound. The *Hope* parted with the *Windward* at Port Foulke, to return, on August 12. Lieut. Peary proceeds northwards in the *Windward*, with sixty dogs, five couples of Eskimo, and sixty carcasses of walrus. His intention is to reach and land at Sherard Osborn inlet, send back the *Windward*, and, with the aid of Eskimo and dogs, push onwards to the pole during several years.

The Norwegian expedition, under the command of Captain Sverdrup, has been fitted out at the expense of three patriotic Norwegians, Consul Axel Heiberg, Arnulf and Ellef Ringnes, and the *Fram* has been lent by the Government. The *Fram* has been a good deal altered, and I think improved as a sea-boat. She now has a deck-house, and better accommodation. Captain Sverdrup took provisions for sixteen men for four years, and he is accompanied by a very efficient staff of six scientific men. His plan is also to proceed up Smith sound as far north as possible, to explore the northern side of Greenland, and also, I understand, to make a push for the pole. We cordially wish all possible success to these two gallant explorers, to the Norwegian Captain Sverdrup, and the American Lieut. Peary.

The exploration of the antarctic regions has now become the most important geographical work of our time. It has been advocated for ten years by the leading scientific societies of this country, especially by the Royal Society, the Royal Geographical Society, and the British Association. It must not cause despondency that so long a time should have elapsed since antarctic exploration was advocated and representations were made to the Government on the subject. It may well take ten years to ensure success, under ordinary circumstances. It took Sherard Osborn and myself over twelve years of hard and constant work before we obtained the despatch of the arctic expedition of 1875. We might not, therefore, be disheartened now if time was of no serious consequence; but there are powerful reasons for urgency, and delay would be a real evil, for other countries do not move at snail's pace.

The antarctic agitation has spread over Europe, and is no longer confined to Great Britain. Indeed, Prof. Neumayer of the Hamburg Naval Observatory has been unceasing in his advocacy for quite as long a time as the scientific societies in this country. The natural consequence has been that more than one small and inadequate undertaking has been set on foot. M. Gerlache, the commander of the Belgian expedition, with very small means when compared with the work to be performed, bought and fitted out a Norwegian vessel, which he named the *Belgica*. She finally sailed from Antwerp, and was last heard of nearly a year ago, when she was in Magellan's strait, on the point of starting for the antarctic regions. The intention of M. Gerlache was to return to Melbourne in April. But she has not since been heard of, and she must have passed the winter of this year in the antarctic ice. She will be the first vessel that ever wintered in the antarctic regions. If there are no tidings of the *Belgica* before next spring, there will be increased cause for anxiety. Sir George Newnes has also purchased a vessel named the *Pollux* at Arendal, in Norway, fitted her out in Norway, appointed Norwegian captain and officers, and given the direction of his expedition to Mr. Borchgrevink, a Norwegian, who gave us some account of his intentions last June. But all this was done without consultation with the Council of our Society, or with any competent authority. Mr. Borchgrevink told us that he intended to proceed to Cape Adare, the nearest point of Victoria Land, make his winter quarters there, and send the vessel back. In the spring and summer of next year he would attempt to make a journey into the interior, and in the autumn the vessel was to call for him and take him and his party on board again. The name of the vessel was changed from the *Pollux* to the *Southern Cross*, and she sailed from London on August 22 last. We wish Mr. Borchgrevink and his companions all possible success.

I venture, however, to think that it would be wiser, and much more conducive to success, if generous-minded individuals who resolve to make a large outlay on exploring work, would take experts into their confidence, consult the best authorities, and work in concert with the Council of our Society or some other competent body of advisers.

Combined effort should be the motto of those who undertake the work of discovery. The Fellows of this Society have been kept fully informed of the policy of the Council since November, 1893, and of the steps that have been taken to secure the despatch of a Government Antarctic Expedition. This year a permanent Joint Committee for the promotion of antarctic exploration has been formed, consisting of the President and officers and of three Fellows of the Royal Society, and of three Fellows of this Society, including the President. In this arrangement there is the great advantage of combined effort in close connection with the great and illustrious body which is consulted by the Government on all scientific questions. This Royal Society Committee has decided not only to give moral support, but also, if possible, substantial support to the antarctic project; and a recommendation to this effect has been made to the Government Grant Committee. But, on the other hand, the present Government has declined, under existing circumstances, to undertake such an enterprise. My friend and old messmate, Admiral Sir Vesey Hamilton, himself for several years the first Sea Lord of the Admiralty, has conclusively dealt with the objection raised, namely, that naval officers, if employed in the antarctic seas, might be out of reach of the telegraph wire for a few months, or, to use the exact words, "they would necessarily be out of reach for a protracted period, in case of being required for the active duties of the fleet." The admiral has shown that Great Britain's naval supremacy will not be endangered, because a few young lieutenants are employed on detached service. It is true that it is more than likely that there may be changes of policy at the Admiralty, and that the views at present held do not represent a permanent policy of abandonment. Experience has shown that this may be the case. We have had similar refusals before, followed, after an interval, by a return to the wisdom of former days—of the days of John Barrow and of Francis Beaufort. Doubtless it will be so again. But, as regards an Antarctic Expedition, there can be no further delay without deplorable consequences. The question is one of urgency.

The Germans will certainly despatch an antarctic expedition in 1900. Dr. Neumayer, the great authority on terrestrial magnetism, has been working with this end in view for years. Twice he has addressed English audiences on the subject within the last three years, once at the International Congress in 1895, and again at the meeting of the Royal Society last February. He expressed a hope that the work would be carried out simultaneously by expeditions from several countries. Through the continued exertions of Dr. Neumayer and others, promises of support for an expedition gradually came in. Now, I understand, success has been secured. A steam-vessel, specially designed and equipped for antarctic service, will be built at Bremershaven. The Government, wiser than ours in this respect, will help with funds and in other ways, and will lend officers, even although they may have to go some distance from the end of a telegraph wire. Dr. Erich von Drygalski, the distinguished Greenland explorer, will lead the scientific staff. Dr. Neumayer looks to us for co-operation. The question is, Are we to hold back? Is this country to resign its proud old position in the van of discovery and exploration? Our credit is at stake. You will understand now why we cannot wait for Admiralty changes of mind. It ought to be a Government expedition under naval discipline. But if our navy is to be deprived of its right, the next best thing must be done: we must appeal to the country. This is the reason that the antarctic question is one of urgency.

England owes her commercial greatness to the munificence of her merchant princes. They have ever stepped forward in times of need. The power that wealth supplies has, over and over again, been used for patriotic ends, above all to promote discoveries, and the spirit of maritime enterprise among our people. Let us pass some of these good men and true of olden times in review, and hold them up as examples for posterity. Not to go so far back as to William Canynge of Bristol, who preceded John Cabot in the promotion of distant voyages, we commemorate Master William Sanderson (of the Fishmongers' Company), one of the most enlightened adventurers of his time, to whose munificence is due the discovery of Davis strait. Voyagers who pass up it to enter Baffin's bay, sight the mighty cliff which bears his name, and the instructed among them take off their caps as they pass Hope Sanderson. We commemorate Sir Thomas Smith, the founder of the East India Company, the patron of maritime enterprise, whose name I have had occasion to use more than once this evening, in referring to the famous sound which bears it. We commemorate Sir Thomas Roe, the great ambassador, Sir Dudley Digges, Sir John Wolstenholme, Lancaster, Jones, Wyche, and many more adventurers who, in the days of old, by their aid, fostered the spirit of discovery and maritime enterprise, and thus advanced the prosperity and the glory of their fatherland. All honour to their memories. They are immortalized by capes and bays which bear their names; all except Richard Wyche, director of the East India Company and of the North-West Company, and a great promoter of Spitsbergen exploration, whose island has been improperly filched from him, though the name was given by Captain Edge, the gallant explorer who discovered it in 1617, in memory of his employer's patriotism.

A century elapsed from the days of Byron to the days of Franklin, when the need for private munificence was not felt, in the promotion of geographical research. It was not felt because our governments then recognized what was the true and best work for the navy in time of peace. Nor did they allow the progress of discovery to be checked in time of war. They did their duty in this respect, and upheld the credit of their country. They kept the British navy in the van of scientific exploration, working for the good, not only of their own country, but of the whole civilized world.

On one occasion during that period, the aid of private munificence was needed, and it was at once forthcoming. In 1829, an eminent distiller, named Felix Booth, equipped an expedition to the arctic regions for Sir John Ross and his nephew. The results were the discovery of the region named Boothia Felix, of the Gulf of Boothia, which long proved to be a remunerative fishing-ground, and of the position of the north magnetic pole. Let it not be supposed that the promoters of such expeditions go without recognition, and that their services are not appreciated by their countrymen and by the Government. On the return of the Rosses, our sailor king, the founder of this Society, promptly created Sir Felix Booth a baronet.

Next after Sir Felix Booth, in the illustrious gallery of patrons of geographical discovery, come the names of Samuel and Charles Enderby. It was under the auspices of my old friend Charles Enderby, who twice served on the Council of this Society, and was one of its original members, that several discoveries were made in the antarctic seas. There must be others living, besides myself, who remember the frequent attendance of old Mr. Enderby at our meetings, until his death in 1877.

Last, but not least, we commemorate the splendid munificence of Mr. Harmsworth, whose efforts have secured a real and solid increase to our knowledge of an important and very interesting portion of the arctic regions.

I cannot, therefore, believe that the patriotic adventurers of the Elizabethan age have no successors; that the race is extinct. I trust that a knowledge of our country's need is all that is wanted. Let it, therefore, be clearly understood that if we are unable to do our bounden duty, and to take our place by the side of the German antarctic explorers, if we are obliged to hold back, our credit as a nation is gone. We must, for the first time in our history, disgracefully take a back place. Worst of all, it will not be from poverty of means, but from poverty of patriotic feeling amongst those who possess the means. But we cannot believe this, and we therefore confidently make an appeal for funds to equip an Antarctic Expedition.

Whatever be the fate of that appeal, the duty of our Council was plain and clear. It was to put the facts, and what was involved by them, before the Fellows of the Society and before the country. This has been done by the publication of the pamphlet which you have all received. Further, the Council has instructed me to make this appeal.

Still further, the Council has resolved to head the list of subscriptions, even if its name should stand alone. There are numerous calls upon our funds, but we have resolved to strain them to the uttermost for this great national work. The Council will head the list with the sum of £5000.

I trust that my voice will not be the only one to be raised in support of the credit and honour of our country this evening. I therefore invite others to bear their testimony, and to discuss the means of raising a fund for the equipment of an Antarctic Expedition.

Prof. **Michael Foster**, Secretary of the Royal Society: Let me, first of all, express the very great regret of the President of the Royal Society, Lord Lister, that, owing to an enforced absence from London, he is unable, as he would have wished, to be present on this occasion. In his absence my brother secretary, Prof. Rücker, and myself are present this evening in order that, while enjoying the pleasure of listening to your President's address, we might at the same time bear witness to the great sympathy which is felt by the Royal Society, not by the Council of the Royal Society alone, but by the whole body of Fellows, with the proposed Antarctic Expedition. There are many reasons why the Royal Society should feel sympathy with such an undertaking. We were founded to advance natural knowledge, and we feel, as it were, hurt when we know that there is any bit of natural knowledge which could be gained, but which is not being gained, for reasons other than the want of intellect to pierce the secret. Then we have from time immemorial been associated with that part of knowledge which is gained by dangerous exploration; nearly all the great explorers have been connected with our Society, and to-night I feel a special pleasure in seeing here one whose name on the one hand is essentially connected with antarctic exploration, and on the other hand is a man of whom the Royal Society is proud as having filled the high office of President to the great satisfaction of all the Fellows for many years; you know him—I mean Joseph Dalton Hooker. Lastly, we have sympathy with this undertaking because there is hardly any part of natural knowledge which will not be the richer for such an expedition. It was, Mr. President, I think, very remarkable, at a meeting which was held at the Royal Society to discuss the scientific gains which might accrue from the antarctic expedition, to note how representatives of one science after another rose and explained what they thought might be gained by the expedition. I think one trumpet gave a rather uncertain sound, and I regret to say that trumpet was blown by a Fellow of your Society. It was most interesting to observe how a younger man at once rose up, and stated that the one gain which would come from such exploration would be that which was rather minimized by the older speaker.

We sympathize absolutely and entirely with this great scientific expedition to explore the antarctic regions, but the Royal Society, though it is supposed to be a society of wise men, is also a society of poor men, or at all events a poor society of wise men. We have hardly money enough to carry on our own work. It would be absolutely impossible for us, much as we should wish to do so, to speak of giving £5000, but we have a hold upon money that does not belong to us. The Government grants the enormous sum of £4000 yearly to use for the cultivation of all branches of science; the committee, to which your President has referred, at a recent meeting, determined to make a definite application to the committee which, under the Royal Society or with the Royal Society, administers this £4000, decided to make a definite application for a sum the giving of which should indicate how that committee, which is representative, not only of the Royal Society, but of all the scientific societies of this country, held in scientific esteem the proposed expedition. It is not so much the sum of money which may be obtained that is important, but the clear indication thereby afforded that this antarctic expedition is an expedition of undoubted and great scientific value. I do trust, speaking on behalf of the Society, that the appeal which has just been made by your President, may find the money in some pocket or other, for last Whitsuntide my brother secretary and myself, with two other Fellows of the Society, took part in a meeting of associated academies and learned societies at Göttingen, and there, I think I may say, and my brother secretary will agree with me, we felt sorry for ourselves. Our German brethren explained to us what they were doing in order to bring about a German expedition to the antarctic regions; they told us what they were doing, how undoubtedly it would receive the support of the Government, and how they felt perfectly sure that in 1900 they would start; and then they said, "What are you doing in England?" and we were obliged to tell them that we believed an appeal had been made to the Government, and we had reason to think that that appeal would be in vain. But it would be a great thing if it could be shown once more, as it has been shown on many occasions before, that in England the Government is not everything—that Englishmen now, as of old, can do with their private hands what the Government is not bold enough to do, and I think I may say, on behalf of the Royal Society, that if we had money we would give it, but not having money, we join the wish of your President, that some one else may give it.

Professor RÜCKER, Secretary of the Royal Society: My colleague has laid before you the views of the Royal Society so excellently that he has left little for me to say. One of the reasons why we both wished to come here was, that we wanted to do what in us lay to impress upon any one interested in this matter, that it is one on which the scientific world is unanimous. There are occasions on which the different branches of science seem to a certain extent to compete with one another, either for the loaves and fishes, which both cannot enjoy, or to attain one of two objects, each of which appeals specially to those interested in some one branch of science; but on this occasion the physicists and the biologists stand side by side, for both one and the other know that there are matters of the greatest scientific importance, which can be solved, and solved only, by an antarctic expedition; and therefore we were anxious to impress upon you all—though I believe that very little requires to be done in this hall—the importance of the matter, and the fact that the Royal Society as a whole is anxious that the work should be carried out. It has been my good fortune to have spoken more than once in this hall on the question we are now discussing, and I have laid before you what are the objects to be gained in the cause of the science of magnetism. I will not repeat what I have stated before. But in addition to the meeting to which my colleague has referred, held at Göttingen, I have this summer attended a meeting composed of magneticians only. During the meeting of the British Association at Bristol I was President of the magnetic conference, and one remark made there, which bears on the question, was, that at present the mathematical theory of terrestrial magnetism, the machinery of the mathematical methods, is far ahead of the accuracy of the observations themselves. I don't mean by that that observations carried out by first-rate observatories lack accuracy, but I mean that the observatories are crowded into the better-known parts of the world. The two things wanted to enable us to obtain a fuller, clearer picture of the magnetic state of the Earth are, the establishment of more observatories, especially in the tropics, and perhaps still more important than this, a survey of the antarctic regions. It is for these two things that magnetic science has been waiting. We are ready with our mathematical machinery, if only investigation will give us the facts upon which the structure of theory may thereafter be built. I cannot, therefore, but hope that this great expedition will be carried out, for I can only concur with Prof. Foster, when he said it was with feelings of deepest depression that Englishmen, who are accustomed to consider themselves leaders in such matters, should see this German expedition planned and preparations made for carrying it out, while we lag behind; it is, indeed, particularly distasteful to the patriotism of English scientific men. I don't think, therefore, that, in putting this matter before you, too much stress can be laid on the fact that it is of the greatest importance that the observations of the two expeditions should be taken concurrently, as they would then be of far more value than the observations of two expeditions taken several years apart from one another. The two expeditions should co-operate one with the other, in the sense that the observations should be carried out with one common object and in regions which had been arranged between the two.

I therefore hope that some one may come forward to help us in this matter, and this great expedition may be sent out. The Royal Society has done, and will do, all that it can in making an application to the Government Grant Committee; although our regulations do not enable us to state what the result of this may be, our great endeavour will be to get a substantial sum, to prove that our interest is not merely platonic. I trust that on this occasion, when all scientific men are unanimous in support of this object—when, indeed, all civilized countries are unanimous as to its importance, that England will be found not lagging in the rear, but once more taking its place in the van.

The PRESIDENT: I rejoice to see present here this evening one we all venerate, although I scarcely hoped to have seen him, and it only shows the deep interest he takes in the subject before us. I allude to our late Vice-President Sir Joseph Hooker, who is the sole survivor of the famous antarctic expedition of Sir James Ross. I trust that Sir Joseph Hooker will kindly address a few words of encouragement to us.

Sir JOSEPH HOOKER: It is, perhaps, only natural that I should look back before I look forward, and I cannot help being reminded of the old proverb regarding hope deferred making the heart of man sick. I will confess to you, sir, that your previous gallant attempts to galvanize an antarctic expedition into existence gave me boundless hopes, only to be disappointed; but, at the same time, let me assure you that every new effort you made was met by a rebound of hope on my part, and on no occasion more than on the present occasion, because I consider that the way you propose to go to work is the most promising as yet made. We must depend upon our own resources, with the national will and the national effort, and I feel sure these will be accorded. If I understand your project rightly, it is to cut our coat according to our cloth, therefore the size of the expedition must depend upon the support we can receive; but I do venture to hope that, whatever it may be, we should commence as soon as sufficient funds are raised for the purpose, whether with a single small vessel, or with a couple of ships of the character of the *Challenger*. Between those there is plenty of room to choose, and our choice must be guided by what we can afford. Now, I foresee that the success of the expedition will depend not so much upon the size of the force we can send, as upon the nature and character of the men we send with it. That a single, even small, vessel, seizing its opportunity, may obtain most important geographical results is evidenced by Weddell's having, in a mere cutter, reached open water in the 75th parallel, and this in a longitude where, twenty years afterwards, Ross, in two well-found ships, spent weeks in the vain attempt to reach the 72nd. It remains to express my earnest hope that Englishmen, all the world over, will liberally respond to our President's appeal. In respect of the colonies, it has always appeared to me that the apathy shown by Australia and New Zealand especially, to former efforts to obtain their substantial support, was in a great measure due to the representations made to them from this country not having been efficiently delivered and vigorously followed up; and I would suggest for consideration the expediency of making a further effort by applying, not only to the Governments of these colonies and those of South Africa, but simultaneously to their leading scientific societies and influential residents, and their daily papers. It might at the same time be pointed out that there are many ways in which efficient aid could be appropriately offered, and gladly accepted, such as refitting, victualling, and perhaps even financing the expedition, when wintering in their harbours. Such aid as this, I feel sure, need only to be indicated to ensure their being offered.

Admiral Sir Erasmus Ommanney: I congratulate Sir Clements Markham on the admirable address he has given us this evening on the present state of geographical science and of geographical discovery. I wish to express my great pleasure at being here, because Sir Clements Markham was a youngster under me in 1851. I have had a great many pass under my hands, but none that have risen to such eminence as Sir Clements Markham. I have taken some interest in antarctic exploration, partly from the circumstance that I was shipmate with Sir James Ross and Captain Crozier in the year 1836, on a very perilous expedition to the arctic regions in the depth of winter. I believe there is nothing in naval records which has been so glorious as that expedition of James Ross to the antarctic regions. In looking up the memoirs of that expedition to-day, I see that the most eminent philosophers of the time urged the country to undertake the expedition. I have no doubt, when this address is circulated, it will rouse the same interest in philosophical men to support the object we have in view. It is sixty-two years since that expedition went out. Great advantages will be gained by sending forward an expedition now, especially as the naval officers of the present day are men of the highest scientific attainments, and anything sent forth by the Admiralty will redound to the credit of the country. I shall do my best, as I have done at all times, to support this movement. I think it is well to know what the general feeling is on the subject. I took the initiative some years ago, in 1885, in bringing the subject before the public; some years after that I acted as secretary of the committee of the British Association in promoting this object, and I was in communication with the Geographical Society of Victoria, and had thus the means of ascertaining the feeling of our colonies in Australia and New Zealand. Their approval was unanimous, but the only colony which gave any tangible proof was Victoria, which voted £5000, on condition that this country voted another £5000. This was submitted to the Government, and they submitted it to the Royal Society, who decided that £10,000 was not enough for such an expedition. Another time Sir John Elder said he would give £5000 on condition that enough money was collected, but it was not obtained. I believe that the result of this meeting will meet with the approval of the whole world, and I hope that I may live to see the expedition set forth.

Admiral Sir Leopold M'Clintock: With regard to the exploration of the antarctic regions, I do not propose to add a word, or as to the undoubted value of such an enterprise. I will only speak a few words about the Admiralty and naval officers. I think our President is now looking to scientific men throughout the country for that support which the Admiralty and Government have declined to give just at present. In times of profound peace, the Admiralty and the country have, I think, heartily supported these expeditions; but now there are some ugly clouds floating in the political atmosphere which keep the Admiralty at the present time very busy; and also we must bear in mind, in regard to naval officers, that they are not unlike other men, and that man is a fighting animal, and if there is a chance of a fight, you won't get naval officers to devote their attention to matters of abstruse scientific interest. I do hope that a little time will bring the Admiralty round, and that with changed circumstances we shall have a Government expedition, and, if so, we shall take a great geographical spring forwards.

Admiral Sir WILLIAM WHARTON: The President puts me in a difficult position, because he has devoted a part of his remarks to-night to, we will say, animadverting a little on the conduct of the Admiralty and the Government in declining to entertain the proposition to send out a Government expedition to the Antarctic. I think that a little bit too much has been put upon the Admiralty; but, however, I am not here to defend the Admiralty; although I am an Admiralty officer, I have my own opinions on the subject, and I think I am quite entitled to express them here without in any way committing the Admiralty to them. I should like to say, with regard to an expedition of this kind, that the Government has to consider that any expedition sent out must be a very complete one; and there is no doubt that it will cost a great deal of money. That is nothing really to this country, but still you have to persuade the keepers of the public purse that that large sum of money is necessary, and that is a little difficult, as this is a matter of pure science. We don't think so; we think the scientific results are worth anything, and there is no doubt that such an expedition would be an immensely popular one in the navy. There would be crowds of officers asking to be sent on such an expedition, and I believe it would be better carried out under the auspices of the Government, because it is one of great difficulty, and you want strict discipline; but the Government have, for the time being at any rate, declined to offer their aid, and I am very much of opinion that if a small expedition be sent out by private aid, it will be able to do a great deal, proving the forerunner of a larger expedition afterwards. We have often seen that private enterprise gives the start and moves the country. This could be carried out for a very much smaller sum of money than would be necessary for a Government expedition, as long as they don't start out with the idea of doing as much work as a Government expedition would do, and I am very much in hope that Sir Clements Markham's appeal will end in that aid being given us.

The PRESIDENT: I hope that the meeting is as well pleased as I am with the result of the discussion which has followed my address. We have heard from the secretaries of the Royal Society what a deep interest that great institution feels in the success of our efforts. We have been encouraged in a way that we scarcely hoped for by one who knows the dangers of antarctic service, Sir Joseph Hooker. We have been reminded of all the work done from the beginning by Sir Erasmus Ommanney; we have been encouraged also by Sir Leopold M'Clintock, and above all by the hydrographer. I can bear witness to what he said about the desire of the navy for any work of that description. I remember very well when Leigh Smith was lost, I wrote to Captain Bedford at Greenwich, to see if any naval officers were inclined to go out to help in the search, and when I went down there, there was such a crowd in his office and all round it that I could hardly get near—in fact, all Greenwich seemed to have volunteered. I have had letters from all parts of the world showing the same feeling in the naval service, and I say it is a reason for regret that the navy is deprived of the work that belongs to it; but if it is so deprived, we must use every effort to raise a fund to enable us to take the place of the navy. I do trust that the address, and the discussion which has followed, will be of some service to the cause we have at heart. I have nothing more to add but the expression of my belief that this great meeting is with us.

A DESCRIPTION OF CHRISTMAS ISLAND (INDIAN OCEAN).*

By CHAS. W. ANDREWS, B.Sc., F.G.S., Assistant in the British Museum (Natural History).

ONE of the most interesting of the lonely islets of the Indian Ocean is Christmas Island, which lies about 190 miles south of Java, in S. lat. 10° 25′, E. long. 105° 42′. The seas around it are of enormous depth, and soundings of over 1000 fathoms occur within 2 or 3 miles of its coasts. To the north and north-west is Maclear Deep, in which 3200 fathoms were found, and to the south is the more extensive Wharton Deep, with upwards of 3000 fathoms. The island, in fact, rises from the summit of the low submarine ridge which separates these two abysses, and on the westward end of which the Keeling-Cocos Islands are situated.

The first mention of the island occurs in a map by Pieter Goos, published in Holland in 1666, in which it is called Moni. In subsequent maps, this name and that of Christmas Island are applied to it indifferently, but it is not known by whom the island was discovered and named. The earliest approach to a descriptive account is found in Dampier's 'Voyages,' † in the following passage:—

"After leaving New Holland, the ship tried to make Cocos, but was driven to a more easterly course, and met nothing of remark till the twenty-eighth day. Then we fell in with a small woody island in lat. 10° 20′. Its longitude from New Holland, from whence we came, was, by my account, 12° 16′ W. It was deep water about the island, and there was no anchoring; but we sent two canoes ashore, one of them with the carpenters, to cut a tree to make another pump; the other canoe went to search for fresh water, and found a fine small brook near the south-west point of the island, but there the sea fell on the shore so high that they could not get it off. At noon both the canoes returned on board, and the carpenters brought aboard a good tree; the other canoe brought aboard as many boobies and man-of-war birds as sufficed all the ship's company when they were boiled. They got also a sort of land animal, somewhat resembling a large crawfish without its great claws. The island is a good height, with steep cliffs against the south and south-west, and a sandy bay on the north side, but with very deep water steep to the shore."

The date of Dampier's visit was March, 1688. The next account of the island is given by Captain Daniel Beekman ‡ in 1718. He remarks that "the island looks exceeding pleasant, being covered with lofty trees, and may be known by the following directions: Coming from the north-westward, it appears pretty high, with a saddle in the middle;

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* Paper read at the Royal Geographical Society, November 28, 1898. Map and Sections, p. 104.

† 'Dampier's Voyages,' vol. i. p. 472. Ed. 1829, London.

‡ 'A Voyage to and from the Island of Borneo, in the East Indies,' etc. London, 1718.

the westernmost land is the highest, trenching away to the northward to a low flat point; the easternmost point is low, but bluff. I sounded within 8 miles of the low point, but had no bottom with the 100-fathom line out. The island is about 7 leagues from east to west."

This writer gives a remarkable sketch, in which the heights are ridiculously exaggerated, the hill over the north-western point being made to look like a high mountain with three peaks; his estimate of the length of the island also is much in excess of the truth.

In 1771, the *Pigot*, East Indiaman, attempted to find an anchorage, but failed. The crews of this and other passing vessels reported the occurrence of wild pigs, coconut palms, and lime-trees, none of which really existed.

The first attempt at an exploration of the island was made by the frigate *Amethyst* in 1857, from which a boat's crew was landed with the object of attempting to reach the summit, but the inland cliffs proved an insuperable obstacle, and the ascent was abandoned.

In 1887, the surveying vessel *Flying Fish* (Captain Maclear) was ordered to make an examination of the island. The coast was found to consist of steep limestone cliffs, and it was only after sailing nearly all round the island that an anchorage was found in a bay with a white shingle beach on the north coast; to this the name Flying Fish Cove was given, and it is now the site of a small settlement. Another white beach was seen towards the north-west point, but no anchorage was found near it. A number of men were landed, and some collections of the plants and animals were obtained, but, since the island seemed of little value, no serious attempt at exploration was made.

In the following year H.M.S. *Egeria* (Captain Pelham Aldrich) called at the island, and remained about ten days. Captain Aldrich and his men cut a way to the top of the island, and sent home a number of rock specimens obtained on the way, and Mr. J. J. Lister, who accompanied the expedition as naturalist, made extensive collections both of the fauna and flora, but had not time to penetrate to the middle of the island.

In 1890 H.M.S. *Redpole* called at the island for a few hours, and Mr. H. N. Ridley, of the Singapore Botanical Gardens, who was on board, collected a number of plants not previously recorded, and has written an interesting account of his visit.*

Although Messrs. Lister and Ridley had made valuable collections of the flora and fauna of the island, the shortness of the time at their disposal rendered it impossible for them to penetrate far into the interior, or to make any examination of the geological structure. Nevertheless, the rock specimens brought back by the *Egeria* showed that the island probably consisted mainly of coral and foraminiferal limestones, resting on a basis of volcanic rocks; and a very interesting paper,* in which the results of the expedition were summarized and the probable structure of the island discussed, was published by Rear-Admiral Sir W. J. L. Wharton in the *Proceedings* of this Society for 1888.

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* *Journal*, Straits Branch of the Royal Asiatic Society, June, 1891, p. 123.

It seemed desirable, however, that a more complete examination of the island should be undertaken, and, if possible, collections should be made at different seasons of the year, and in 1896 Sir John Murray generously offered to pay the expenses of such an expedition. I was fortunate enough to be able to avail myself of this opportunity, and, the Trustees of the British Museum having granted the necessary leave of absence, I left England at the beginning of May, 1897.

FLYING FISH COVE—REEF AT LOW WATER.

At that time the only means of access to the island was by the small sailing-vessels belonging to Mr. G. Clunies-Ross of Cocos-Keeling Islands, which are employed in carrying various supplies from Batavia to those islands, and on their way down usually touch at Christmas Island to land stores for the little colony established in Flying Fish Cove. Unfortunately, one of these vessels had left shortly before I arrived in Java, and I therefore had to wait some weeks before an opportunity of getting to the islands occurred; but at length, on July 23, I sailed from Batavia in the *J. G. Clunies-Ross*, a yawl of about

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* To this paper I am indebted for much of the information as to the early history of the island given above.

46 tons burden. After a rather rough passage of five days, we sighted the island from the south-west, having run past it in the night. We arrived off Flying Fish Cove soon after sunset, but did not anchor till the following morning (July 29).

Seen from the south-west, the island appears as a long green ridge nearly level at the top, there being only slight elevations at the north-west and south-east ends. The ridge descends seaward in a succession of terraces, the upper ones bounded by comparatively gentle slopes, the lower by a high and nearly vertical cliff, below which there is a narrow platform sloping gently down to the sea-cliff. This is usually about 15 to 30 feet high, and is much undercut by the heavy swell that is continually breaking against its base. On approaching nearer, it can be seen that the whole island is covered with a dense forest, only broken by the grey face of the high inland cliff which runs round the greater part of the island, rising like a wall above the tall trees growing on the shore terrace.

If the coast be examined in a boat or from the top of the sea-cliff, it will be seen that a submarine terrace in the shape of a fringing reef is being formed round the greater part of the island. It varies greatly in width, and also in its depth below the surface; in some places it is partly dry at low water, in others some fathoms deep. Outside the edge of this reef, the water deepens suddenly.

The greatest length of the island, from North-East Point to Egeria Point, is about 12 miles. The greatest width from north to south is about 9 miles; the least 3½ miles. Its area may be roughly stated as 43 square miles.

The outlines of the land, as seen from the south-west, east, and north, and sections* across it at various points are shown in the diagrams. From these it can be gathered that it consists of a central plateau, highest toward the north and east, and descending to the sea on all sides by a succession of terraces separated by slopes or cliffs. In most places the arrangement of these, from the edge of the plateau downwards, is (1) a steep slope strewn with blocks; (2) a broad terrace, followed by a similar slope (this seems to be wanting on the south); (3) a second terrace, terminating in a cliff 200 or 300 feet high; (4) the shore terrace sloping gently down to the sea-cliff; (5) the present fringing reef. There are, however, many local differences, the more important of which will be noticed below.

The Central Plateau.—The edge of the central plateau is roughly parallel to the coast, receding farthest from it opposite the principal headlands. It is highest along its northern and eastern borders, where there is a raised rim, the average height of which above the sea is

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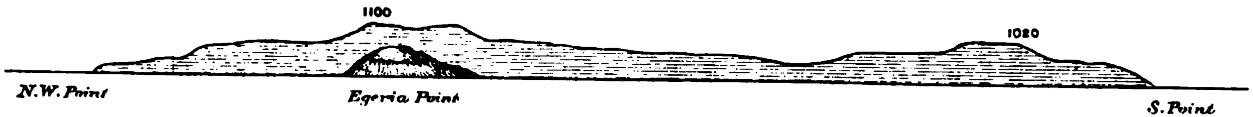
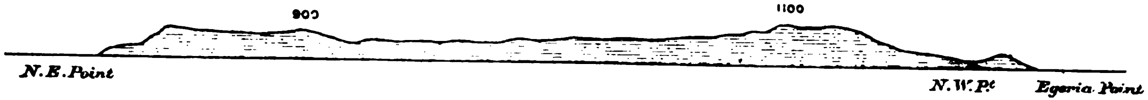
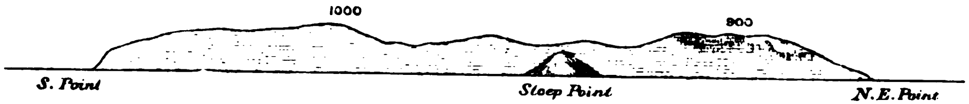
* The sections across the western and north-eastern parts of the island are mainly founded on a survey of roads made by Mr. G. Ross in 1897.



From South West.



From North.



From East.

CHRISTMAS ISLAND

about 800 feet. Towards the south it slopes away so that its edge is only from 400 to 450 feet high, but there are some slight elevations above this general level. On the west the upper terraces are replaced by a gentle slope, and even the first inland cliff is not well marked except towards North-West and Egeria Points.

Along the raised rim of the plateau there are a number of hills, the highest of which (Murray Hill) occurs towards North-West Point. It is a nearly flat-topped hill, divided by an oblique valley into a larger and rather higher western portion, and a lower eastern one; the greatest height is about 1170 feet. The summit is formed by masses of dolomitic limestone, and on its lower slopes there are beds of shelly limestone, and a peculiar deposit which seems to be mainly made up of tiny spherules of altered volcanic glass. The outer face is very steep, but toward the south the land first descends gently, then rises a little, finally sinking to the general level of the plateau in a long gradual slope. On the south-western side there are occasionally patches of rounded pebbles, which are of a volcanic nature, and are, perhaps, derived from the bed above mentioned. Similar nodules occur in many places on the higher parts of the island.

The next highest hill (Ross Hill) is over South Point. It also has a flat top covered with dolomitic limestone, in which traces of gastropod shells are visible. On its outer side there is a low cliff, and below this a long steep slope covered with blocks of limestone in the wildest confusion, and thickly overgrown with creepers and brushwood. Towards the plateau also the descent is rather abrupt.

Over North-East Point is another elevation (Phosphate Hill), which, though not so high (900 feet), is particularly interesting on account of the extensive deposit of phosphate of lime which is found there. This substance is strewn over the surface in blocks of all sizes, and in some places it is found to a considerable depth; in others, however, it can be seen to rest directly on an irregular surface of dolomitic limestone, occasional pinnacles of which project through it. At the northern end of the hill the phosphate is found on both outer and inner slopes, but farther south on the plateau side only, the outer being occupied by a reef of limestone, which descends to the terrace beneath in a low cliff. The area actually covered by this thick deposit of phosphate of lime is about half a mile long by a quarter broad, but an immense quantity occurs in the form of irregular nodules and blocks scattered over all the slopes and terraces of this part of the island. There are other less extensive beds over Flying Fish Cove, and also at several points along the eastern edge of the plateau. Probably, when the islands were still low and not covered with forest, they formed the homes of myriads of sea-birds, and the guano thus formed, after undergoing alteration mainly through loss of its organic matter, gave rise to the hard phosphatic rock now existing. At the same time the limestones on which it rests have often been phosphatized, and lumps of coral consisting mainly of phosphate of lime are sometimes found. The extensive accumulations of guano which must have taken place point to a time when the rainfall was much less than at the present day, a condition which may, at least in part, have been dependent on the circumstances that the islands were low and probably free from forest.

On the eastern rim, between Phosphate Hill and Ross Hill, there are several smaller elevations, all presenting similar characters, viz. having on their seaward side a steep talus slope or low cliff, a flat top, and a moderate declivity on the inland side. Between the hills both on the north and east coasts, the rim of the plateau varies a good deal in character. As a rule, its outer edge is marked by a kind of rampart of lines of limestone pinnacles separated by channels, but sometimes it descends by a gentle slope; in either case beneath the cliff or the slope there is always a steep talus-strewn declivity passing down to the first terrace.

NORTH COAST, LOOKING NORTH-EAST TOWARDS SMITH POINT.

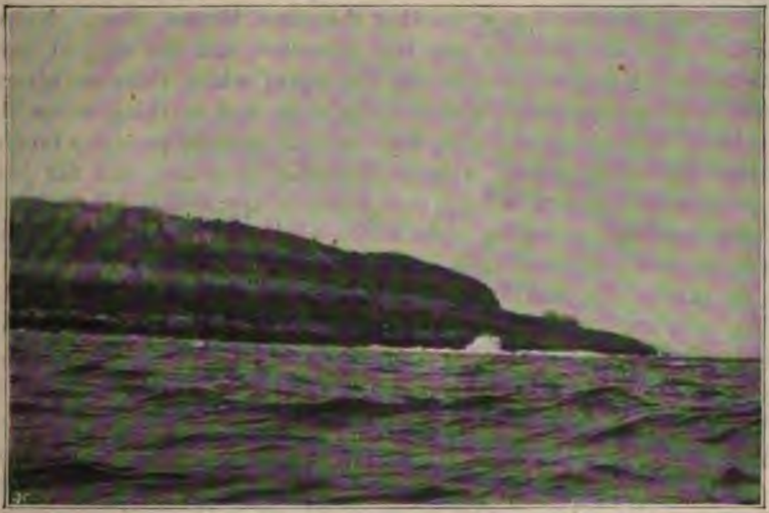
The northern part of the plateau within the elevated rim is particularly characterized by the presence of numerous low hills (about 50 feet), with more or less flat tops covered with blocks and pinnacles of limestone. Further south there are several step-like ridges, running in an approximately east-and-west direction; their southern face is covered with blocks of limestone, composed mainly of rather fresh-looking corals. In a few places similar limestones form extensive reefs, cut up into deep channels and holes. These reefs, when covered with thick bush, form almost impenetrable obstacles.

The Upper Slopes and Terraces.—As already mentioned, there is beneath the edge of the plateau a steep slope usually covered with talus; where the rocks composing it are exposed they are found to consist of foraminiferal and coral limestones, and are often full of angular fragments of older limestones. Beneath this slope is a level terrace varying in width from a few yards to a quarter of a mile or more, and bounded on the seaward side by a second steep declivity, or in places by an actual cliff. The rocks composing this usually show very distinct traces of coral, and sometimes seem to be entirely composed of it. This slope is absent on the southern side of the island.

The next terrace also varies considerably in width; on its outer margin there is usually a broad belt of limestone pinnacles, separated by channels. In the neighbourhood of Steep Point, it rises into a rounded hill covered with blocks of phosphate of lime. This hill must have formed a small islet at the time the foot of the second inland cliff was washed by the sea. In other places there is a channel 40 or 50 yards wide running parallel to the edge of the cliff; the inner side is formed by a cliff 30 or 40 feet high, the outer by walls and pinnacles separated by branching channels, the floor of which, like that of the main channel, is perfectly level. Towards the sea there is a steep slope covered with blocks of limestone. When the sea was from 350 to 400 feet higher than at present, this channel formed a sort of canal in the reef parallel to the coast.

Beneath the terrace just described comes the first inland cliff, by far the most conspicuous feature of the island. Usually it has a vertical, or nearly vertical, face, and it is especially well marked at the headlands. Its summit is from 250 to 300 feet above the sea. In several places about 150 feet above the shore platform there are distinct traces of wave action, the most notable being the presence of caves along this line. In some cases beneath this point, instead of a vertical face, we find a steep slope of limestone with coral in position of growth, apparently the remains of a narrow fringing reef, founded upon and partly composed of talus. The fact that the elevation of this cliff has been of an intermittent character is further shown by the fact that where the slopes of the island are gentle and no high cliff has been formed, there is either a succession of minor cliffs separated by terraces and partly built up of coral rock, or merely a slope with ledges of coral limestone. Although these minor cliffs and ledges may be continuous for some distance in any given locality, they do not always correspond to those found a few miles off. It must also be noted that the geological structure and even the origin of this cliff is not everywhere the same, a point that will be referred to more fully below.

The shore terrace slopes gently down from the foot of the first inland cliff to the sea-cliff, which is from 15 to 30 or more feet high, and is often undercut by the waves to a remarkable extent, so that it sometimes overhangs more than 20 feet. The inland side of this terrace is usually covered with pinnacles of rock similar to that forming the cliff above, and formed part of the fore-shore planed down by the waves. Near the sea the terrace is clearly a raised fringing reef resting on a foundation of talus; the corals are often very fresh in appearance. In some localities this platform has been cut into the older rocks (orbitoidal limestones, basalts, etc.) which form the basis of the island, and in such places small streams may occur, the water being held up by the volcanic rocks. The point where these are best developed is on the east coast, where there are two or three muddy brooks and a small fall of excellent water, which gushes out over a bed of basalt just above high-water mark.



NORTH-WEST POINT.

On the south, where the cliffs are exposed to the full force of the swell produced by the south-east trade wind, which blows most of the year, the coast scenery is very fine. The cliffs are cut into numberless narrow inlets, and their summits are often completely bare of vegetation for some distance from the sea. Blow-holes are very numerous, and several columns of spray rising high above the trees may often be seen at once.

At various points round the coast there are shingle beaches. The most important of these are those in Flying Fish Cove and West White Beach (see map), at both of which landing is fairly easy. There are also two or three others on the north coast, several on the east, and one or two towards the northern part of the west coast; most of these are small, and are shut in by cliffs, and covered at high water.

The above is a brief account of the usual plan of the island, but there are several localities in which considerable divergences from this occur. One of these is Steep Point, where a deep fissure, forming a narrow valley, has cut off an angle of the first inland cliff, and the portion thus isolated has tilted forward so that the usual shore platform, if it ever existed, has been carried beneath the sea, and the headland, which is 150 to 200 feet high, is, in fact, part of the first inland cliff.

Again, on the east coast, near North-East Point, extensive slips or faults have taken place, the result being that the ordinary terraces are replaced by a single precipice 500 to 600 feet high, the foot of which is covered by talus of enormous blocks of limestone. In this case the edge of the island as far back as the second inland cliff has slipped down beneath the sea, and has helped to build up the foundation upon which the reefs now forming the shore terrace grew. Nearer North-East Point the slip was less extensive, and the slipped mass here forms the first inland cliff, on the top of which there are several step-like ridges running parallel to its edge, and marking minor dislocations. The rock comprising both this cliff and the precipice further south seems to be almost wholly orbitoidal limestone, the flat joint faces of which give it a very characteristic appearance; the cliff on the southern side of Egeria promontory is similar, and the small cliffs resulting from successive slips can be seen in the photograph.

At the western end of the island the upper cliffs are replaced by gentle slopes, and even the first inland cliff is ill defined, except towards North-West and Egeria Points. Another characteristic feature of this region is the occurrence of several valleys running down to the sea in a generally south-westerly direction. These first commence as a shallow depression at about 400 feet, but as they are followed seawards, deepen to a narrow gorge which cuts through the first inland and sometimes the sea cliff also. The scenery of these valleys is the most picturesque on the island, and reminds one a little of the dales in the mountain limestone in the Peak District. The floor is generally formed of volcanic rock (basalt), and in the wet season is occupied by a small stream, which descends to the sea by a succession of falls and rapids; at the time of my visit water was only found in the northernmost valley.

The last locality to be described is Flying Fish Cove, by far the most important, because it seems to supply the key to the structure of the island as a whole. In the large-scale map of this district, it will be observed that at this point the sea-cliff is interrupted, and its place taken by a long curved stretch of white shingle beach, in front of which a broad fringing reef stretches from one end of the cove to the other. Behind the beach is a nearly level platform, composed mainly of blocks and fragments of coral mingled with talus from the cliff above. This level has been, for the most part, cleared and planted with coconut palms, fruit-trees, and vegetables, and is the site of "Clunies-Ross

Settlement," which consists of some nine or ten houses, workshops, and stores. The cliff forming the back of the cove is about 500 feet high in the middle, but decreases in height towards the ends, and towards the north the slope becomes less steep. For the greater part of its length it consists of alternations of low, more or less vertical cliffs, with steep talus slopes; but towards the southern end, the upper part forms overhanging precipices 200 feet or more in height, while the lower portion is covered by a talus slope of limestone blocks, often as large as a fair-sized cottage. Some of these lie far out on the reef. In this cliff and in its immediate neighbourhood we have almost the only section from which it is possible to get an idea of the nature of the foundation upon which the upper reefs have been established; almost everywhere else the central portion of the island is concealed by the investing covering of more recent limestones which have formed round the island, either as sediment derived from the higher coral masses, or as reefs which have grown on the slopes of the island during its elevation. The circumstance that nearly all the rocks of the island are white limestones, often largely made up of fragments of older beds or containing fossils derived from them, renders the interpretation of the facts observed a matter of great difficulty. It will not be necessary, however, here to enter into details of the geology of the island, and only a brief sketch of the structure of the neighbourhood of Flying Fish Cove is given.

STEEP POINT.

Round the greater part of the cove, about halfway up the cliff, there is a thick bed of yellow foraminiferal limestone, the nearly vertical face of which is from 15 to 60 feet high. Beneath this, and apparently penetrating its lower surface, are several masses of volcanic rock, mainly basaltic. Above the limestone is another bed of basalt, upon which there are thick bands of palagonite tuffs, and occasionally traces of basalt above these again; but the upper slopes are so thickly covered with soil and fallen blocks of limestone, that it is difficult to determine the exact structure of this part of the cliff. About the middle of the cove, the hard limestone is found at a rather higher level, apparently the result of faulting, but its relations to the volcanic series are the same. Southward of this the bed dips downward towards the shore, and the basalt and tuffs resting upon it disappear abruptly, their edges being overlapped by hard white limestone with Orbitoides. This rock forms the upper 50 feet or so of the cliff throughout its northern half, and on the summit occurs in low cliffs, ridges, and pinnacles. At the southern end of the cove it thickens out to a cliff some 250 to 300 feet high, the lower part of which is penetrated by masses of basalt. On the terrace above the cliff to the southward this limestone is found on the eastern and western sides of a broad belt of basalt, which forms a series of rounded hills with valleys opening toward the sea. On the eastern side its base is about 500 feet above the sea; on the west, where it is largely concealed by the more recent deposits forming the cliffs and terraces representing the first inland cliff, it is only 300 to 350 feet. No doubt this limestone once completely covered the basalt, but has been removed by denudation; and, in fact, further south the volcanic rock is completely concealed by limestones.

Further inland, above the orbitoidal limestones comes the steep slope of the second inland cliff, which is here largely composed of corals; shells of mollusca are also found, and there are some beds of foraminiferal limestone without Orbitoides. Above this cliff is a long slope with lines of limestone pinnacles parallel to its edge, and above this again the upper inland cliff or rather slope. Along the foot of this there are some ridges of coral limestone; but towards the summit it rises into rounded hills of dolomitic limestone, with a great many blocks of phosphate of lime here and there. These hills are probably the remains of islets along the edge of the lagoon (now the plateau) before the first elevation of the island took place.

The history of the island, as far as it can be made out, seems to have been as follows: At first, at no great depth, there was a submarine bank upon which numerous foraminifera, including Orbitoides, lived, and the shells of which formed thick beds of limestone. The foundation of this bank was volcanic, and from time to time lava was erupted through and upon the limestones: the occurrence of thick bands of palagonite tuff indicates that the eruptions were submarine. Some elevation took place, and the beds of tuff became consolidated by the infiltration of lime. In the next place, the whole was covered with thick beds of white limestone crowded with large Orbitoides. These strata seem to have overlapped the edges of the beds of tuff, and in places it can be seen that they dip away from the central mass. The deposits resting on the orbitoidal limestones are for the most part covered with recent accumulations, but they appear to have been mainly foraminiferal limestones.

Upon the foundation thus prepared extensive reefs grew up and formed an atoll-shaped group of islands, the reef-flat and islands being now represented by the raised rim of the plateau and the hills rising from it, the lagoon by the central plateau itself. The rounded hills and lofty pinnacles found within the raised margin are probably the remains of knolls and masses of coral growing up in the lagoon, such as may be seen in the Cocos-Keeling Islands at the present day. The height of the hills over North-West and South Points may be accounted for by supposing either that they are points of local elevation greater than that affecting the main mass of the island, or that they represent the higher parts of the bank, upon which reefs were formed before the greater part of it was near enough the surface for the growth of reef-corals. During the formation of these higher reefs, the material

EGERIA POINT.

derived from their wear, mingled with the remains of organisms living round the coast, formed thick deposits of limestone round the flanks of the island.

The first important movement which took place seems to have resulted in the elevation of the northern and eastern sides of the island, the south and west probably remaining submerged. At this time the reefs forming the second inland cliff grew round the north and east coast, and probably some of the ridges of coral limestone running across the middle of the island were formed near the new shore-line on the side of the lagoon.

The next extensive elevation affected the whole area equally, and along the new shore-line the second inland cliff was cut back into the reefs just formed, or even in some places into the central foraminiferal limestones. Subsequently a series of movements of elevation led to the formation of the first inland cliff, or, on the more gentle slopes, to the succession of small cliffs and ridges of coral rock which represent it.

During these various movements much slipping and faulting took place round the island; the effects of this at Steep Point and North-East Point have already been described. As a result of this, and of the action of the waves around the coast, a submarine talus slope was formed, upon which a fringing reef was established, and at the next elevation this was converted into the shore terrace, while its margins were cut back into the present sea cliff. Finally, as already mentioned, a reef is now growing round the island which some day may form yet another raised terrace.* It is a point of some interest that Mr. Andrew Ross, during the eight or nine years he has been residing on the island, has noted the occurrence of two slight earthquakes, the most severe occurring in October, 1895; this was followed by heavy falls of rock from the cliffs.

Climate.—The climate of Christmas Island is delightful, and during the greater part of the year resembles a very hot English summer tempered with sea-breezes. The maximum temperature recorded during my stay was 89° Fahr. on November 20; the minimum, 70° Fahr. on February 13, when it was raining heavily. The greatest range of temperature in twenty-four hours was 14°. The average maximum and minimum may be taken as about 84° Fahr. and 75° Fahr. respectively, the former occurring an hour or two after mid-day, the latter shortly before sunrise. The prevailing wind is the south-east trade, which blows about three hundred days in the year. During this time the sea in Flying Fish Cove is calm, and ships can anchor safely. Between December and May the wind now and then shifts round to the northern quarter for some days at a time, and sometimes blows hard from that direction. At such times the sea along the north coast and in the cove is tremendous, and the valley is filled with spin-drift which wets everything, and rises above the high cliff like smoke. The rain also is very heavy and may continue for a week, but usually the mornings are fine. Occasional heavy showers occur at other times, and in the higher parts of the island are frequent at night. Very heavy dews keep the vegetation fresh even after a long spell of dry weather. The island is perfectly healthy, there being no marshes or stagnant pools, while on the other hand there is a fair supply of good water.

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* In the above account of the probable history of the island, I have frequently used the terms "elevation" and "upheaval." It would have been better to have used Suess's expression, "negative movements of the shore-line," as there is no evidence as to what share in the changes in the relative levels of land and sea must be ascribed to actual elevation of the former.

MOUTH OF SYDNEY'S DALE.

Vegetation.—As already mentioned, the whole island is covered with forest, except the spray-swept edges of the sea-cliff and the vertical faces of the inland ones. Near the sea there is usually a belt of thick low forest of ironwoods (*Cordia*), nyamplons (*Calophyllum*), waroo (*Hibiscus*), etc., mingled with pandanus, which in places forms impenetrable jungles. Outside this the cliff usually has a scanty covering of coarse grass and clumps of bushes (*Pemphis*, *Scævola*, etc.). Within it, on the other hand, the rich phosphatic soil supports a thick forest of lofty trees. One of the most remarkable of these is a species of

Gyrocarpus, or winged-fruit tree, to give a translation of the native name, the fruits of which have two membranous expansions, something like those of the fruits of the ash, by means of which they are carried long distances; except during the rainy season this tree is completely destitute of leaves, and since it is very common it gives a very peculiar aspect to the forest near the coast. Other notable trees are the Boognor (*Berrya*), the timber of which is extremely good, and has been called teak; the buttress tree (*Eugenia*), round the base of which buttress like outgrowths occur, sometimes 10 feet high by 15 or 20 long, and not more than 2 or 3 inches thick—many of the other trees have buttress-like supports, but in none are they developed to this extent; the stinking-wood tree (*Celtis*), the peculiarity of which is perhaps sufficiently explained by its name; the wild sago palm (*Arenga Listeri*). The last is peculiar to the island, and is valuable on account of the excellent sago that it supplies; in favourable localities it may reach a height of from 60 to 70 feet.

Numerous creepers scramble among the treetops and bind them together, and many ferns, including the large birds'-nest fern (*Asplenium nidus*), grow on their trunks and branches, adding greatly to the beauty and variety of the forest scenery. The orchids are few and small. In the middle of the island, besides the comparatively open forest of large trees, there are patches and belts of extremely thick bush, in which the trees, mostly nettles, are not more than 20 to 30 feet high: the undergrowth consists of pandanus, ferns, and creepers, which together form a matted mass exceedingly difficult to get through at the best, and, if growing on a reef of jagged limestone rocks, quite impassable.

Animal Life.—As must be expected in an oceanic island, the fauna is not a rich one. There are only five species of mammals, consisting of two kinds of rats, a shrew-mouse, and two bats. The presence of the rats and shrew must be accounted for by supposing that they were drifted to the island on floating wood, while the bats reached the island by flight. Owing to the abundance of food and absence of enemies, the rats swarm everywhere. At nightfall they appear in troops, and in the bush, within the circle of light round the camp fire, twenty or thirty could sometimes be counted at once, and their peculiar querulous squeaking could be heard on all sides. They get into the tent at night, and even in the house at Flying Fish Cove I have had them run over me while sleeping. They eat nearly everything that can be eaten, and are particularly destructive to the fruits and vegetables that are now being cultivated. A reddish-brown species is by far the more numerous; it is an expert climber, and I have seen it run up the trailing bush-ropes like a squirrel. The second species is black, with thick coarse fur; it is a comparatively sluggish animal, and lives in burrows in small colonies. Both species are peculiar to the island.

Of the bats, one is a small insectivorous species, the other a large fruit bat. The latter is very common, and a great nuisance, both on account of the quantities of fruit, especially papaias, that it destroys, and also because of the noise it makes, its cry being a horribly harsh scream, apparently uttered during both the inspiration and expiration of its breath. One remarkable peculiarity is that this bat has to a great extent abandoned nocturnal habits, and several may often be seen circling about high in the air in the bright hot sunlight, sometimes even in the middle of the day. It is found only in the island, and, according to Mr. O. Thomas, its nearest ally is a native of Lombok.

FOREST ON PLATEAU.

The land-birds, except the birds of passage and a small rail, are all peculiar to the island. They include two kinds of pigeon, a hawk, an owl, a thrush, a species of Zosterops, and a small swift (*Collocalia*). The large fruit pigeon (*Carpophaga*) is very common, and its deep booming note is the most striking sound in the forest in the daytime. The small ground pigeon, with its bright metallic green back, grey head, and chestnut breast, is the most brilliantly coloured of the island birds, but when running among the fallen leaves, its colours harmonize so well with its surroundings that it is very difficult to see. The owl is chiefly remarkable for its peculiar note, which resembles the short bark of a small dog, usually repeated five or six times, but sometimes continued much longer. At night in the forest, half a dozen of these birds may often be heard barking in answer to one another.

The birds of passage nearly all come in the rainy season, and arrive after north and north-east winds; they include whimbrel, plover, snipe, wagtail, swifts, and some others.

The sea-birds are the most conspicuous of the inhabitants, the island being the breeding-place of thousands of frigate-birds, gannets, boobies, etc. The frigate-birds and gannets build in the high trees near the coast; of the former there are two species, one considerably larger than the other—these nest in different localities. These birds are the most important source of the food-supply of the island. They are usually caught thus: A man, armed with a pole 10 or 12 feet long and a red cloth, climbs a high tree near the coast, and, standing on the topmost branch, waves the red rag. The birds are attracted by this, swoop round to investigate, and are knocked down with the pole; in this way enough to supply food for the few inhabitants can usually be obtained without much difficulty.

The reptiles are few and small. There are five or six species of small lizards and a little blind snake (*Typhlops*), which lives in damp places under logs and rocks.

Insect life is fairly abundant. The number of species of butterflies is small, but some of them are very common. Moths are numerous: one grey-and-black species may be seen in thousands, packed together in solid masses several feet long, on rocks and branches of trees. The number of beetles is not very large, but there are several wood-borers which cause great damage to certain trees. After north or north-east winds swarms of dragon-flies often appear, having most probably been blown across from Java.

There are several species of land-crabs, the most common being a little red crab living in burrows all over the island. The robber-crab (*Birgus latro*) is also very numerous, and if one sits down for a short time anywhere in the forest, numbers can be seen approaching from all sides. They are good climbers, and ascend trees in search of food.

The land mollusca and spiders need not be noticed here. One remarkable circumstance is the occurrence of no less than four species of earthworms, two of which are peculiar to the island; their nearest allies seem to be natives of Sumatra and the Aru Islands. It is difficult to account for the presence of these animals in an oceanic island, since both they and their ova are quickly killed by sea-water.

Inhabitants.—For some years Mr. Andrew Ross, brother of Mr. George Ross, the owner of Keeling-Cocos Islands, has been settled in Flying

Fish Cove with his family and a few men from Cocos. During his stay some substantial houses have been built, wells sunk, and fruit-trees and coconut palms planted, and a small experimental plantation of coffee was also made, and the results leave no doubt that the island is well suited for coffee-growing. Recently a number of coolies have been imported from Java to make the necessary preparations for working the valuable deposits of phosphate of lime. When I left the island in May, 1898, the total population was about forty.

Finally, I must express my deep obligation to Sir John Murray, who rendered my visit to the island possible. My thanks are also due to Messrs. G. and A. Clunies-Ross for their hospitality and assistance while I was on the island; and to their nephew, Hugh Ross, who accompanied me everywhere on my various expeditions, and whose knowledge of bush life was of the greatest value to me.

Before the reading of the paper, the PRESIDENT said: We are going to hear this evening a very interesting account of an isolated island in the Indian ocean, which has remained uninhabited during all the centuries until the last ten years, and therefore has developed its flora and fauna without the interference of man. This of course gives the island a special interest to geographers and to all men of science. Mr. Andrews has been, I believe, several weeks in the island, and has forced his way across it through the forest. We have to thank Sir John Murray for having initiated the plan of exploring this island. I now call upon Mr. Andrews to read his paper.

After the reading of the paper, the following discussion took place:—

The PRESIDENT: Sir William Wharton, who gave so interesting an account of Christmas island a few years ago, very much regrets he is unable to be present this evening. I am also sorry to say my friend, Captain Pelham Aldrich, on whose journal Admiral Wharton's account was based, is also unable to be present; but several scientific men are here, and I am sure the meeting will be very much interested to hear their remarks on Mr. Andrews's paper. I will first call upon Prof. Judd.

Professor JUDD: In listening to the very interesting and fascinating paper which has been given to us to-night by Mr. Andrews, I could not help recalling a conversation which I had with Prof. Huxley shortly before his death. We had been discussing that ever new subject, the origin of coral-reefs, when Huxley observed, "I am convinced, from all that is being done now, that we shall not find any simple, easy explanation of all coral-reefs; that the study of coral-reefs is one of the very greatest complexity; that the conditions under which they were formed must have varied greatly in different cases; and that one theory of their origin will probably not be found to suit all the cases." I think that the experience of the last few years will tend to convince every one of the truth of this observation.

There are, I think, two ways in which the study of coral-reefs may be approached—the first is the method which, by the great liberality of Sir John Murray and the wonderful enterprise of Mr. Andrews, has been so well exemplified in the paper placed before us to-night. This method is to find some example of an undoubted coral-reef, which happens to have been raised above the level of the sea, and then cut into by the action of denudation. In that case we get a coral-reef which has been actually dissected. We can observe all the internal structure of the mass, and make observations as to the nature of the rocks of which it is built up, the organisms of different kinds which have gone to compose its mass. We may hope, from the study of such an upraised and dissected coral-reef, to learn more than we could by studying a coral-reef the greater part of which is buried and concealed beneath the ocean. Now, I am satisfied that when Mr. Andrews and his colleagues at the British Museum have been able to study the wonderful collection of rocks and specimens of organisms which Mr. Andrews brought from Christmas Island, we shall know a great deal more of the nature and composition of coral-reefs than we know at present. But there is one very great difficulty in a study of this kind which must be obvious to every one—it has appeared, from the observations made to us to-night by Mr. Andrews. He pointed out, and no doubt truly, that the hills forming the top of the island were at one time isolated coral masses forming a ring, in all probability parts of an atoll; but the action which has raised these coral-reefs and opened them out by denudation has to a very great extent obscured their origin, and therefore it will require a very great deal of careful study of the nature of the rocks, and the question as to the depth of the water under which each kind of rock was formed, whether the materials were subaërial or submarine, and questions of that sort will have to be carefully considered before the actual origin of the island can be made perfectly clear. Many of these questions are questions of considerable difficulty. Doubtless, as Mr. Andrews has pointed out, the latter part of the history of Christmas Island is a history of continuous but interrupted elevation; but the question whether the period before that period of elevation was not one of long and constant depression is one that I think is open to all geologists and naturalists to discuss.

But I may, perhaps, remind you on this occasion that there is another way in which coral-reefs may be studied. There are coral-reef atolls about which there is no mistake: they are exposed to the surface of the ocean, and we can study them and examine the organisms which are building them up, measure the depth of water within and around them, and so forth; but the difficulty is that the great mass of the reef is buried beneath the waters of the ocean. Now, it has long been felt that if we can only make a hole deep enough in one of these undoubted atolls or other reefs, we should have the means at our disposal of learning much that is new about such coral-reefs. Long ago Mr. Darwin wished, and wished in vain, for that wonderful millionaire (who exists in America, but is so seldom found on this side of the Atlantic), to put down the necessary sum of money, and we have waited and waited in vain, until men of science have despaired of ever finding him; and so we have been trying to do what we can for ourselves. Some enterprising individuals in New South Wales first started the movement and approached the Royal Society; and the Royal Society approached the Admiralty, with the result that a committee was formed at the Royal Society and in connection with the British Association in this country, to co-operate with a committee in Sydney; they fortunately secured the aid of the Admiralty on this side and the Government of New South Wales on the other side. The New South Wales Government agreed to provide the boring apparatus necessary for the work; the Royal Society have, from the Government grant and other sources, been able to supply a large proportion of the funds; and very energetic workers have volunteered their services to go out and direct the work. It was made a *sine quâ non* by the people in Syduey that if a boring were made it should be made in the Pacific ocean, and not in the Indian or any other ocean. Sir William Wharton, who, I regret, is not present here to-night, and to whose enterprise and sagacity the success that has attended the operations in the Pacific is due—and we have heard what he has done in the Indian ocean—after considering the matter, selected an island in the Ellice group bearing the name of Funafuti, as the most promising locality for boring operations. First of all, the expedition went out under Prof. Sollas in 1896, making its headquarters in Sydney; then one from Sydney under Prof. David in 1897; and now some of the pupils of Prof. David have gone out again, and I think we may congratulate ourselves upon the success which has attended these expeditions. In the first place, the Admiralty sent out a most experienced navigator in Captain Field; they made such a complete survey of a coral atoll, working out its form and the form of its lagoon by sounding, and the depths of the ocean round it, that we now know the form and character of a great coral-atoll as it has never been known before. Further than this, very important collections have been made by the naturalists I have named, and others, while the work was being carried on at the boring, and I am happy to say that the boring has been entirely successful. We never thought that we should get to more than a depth of 1000 feet, while the latest news is that it had already reached last August within a few feet of that depth from the surface. It was then going on, and we are waiting daily for later news, which I believe will tell us that this depth has been greatly exceeded. Only a portion of the core, that is of the material obtained, has been examined in this country. It will take a long time for the naturalists of the British Museum and elsewhere to thoroughly work out the whole question, but I may point out that already a great deal of work has been done by my colleague, Mr. Cullis, on the chemical and mineralogical characteristics of the rocks, so far as they have reached this country, and the results are of the greatest interest. Dolomite occurs, and there are many points in which the comparison of materials from Funafuti with those from Christmas Island may be expected to throw much new light on the origin of coral-reefs. One of the most interesting facts is that Funafuti and some others are not mainly composed of coral, but botanists may lay almost as much claim as the zoologists to these structures, for the calcareous algæ form as large a part of the reef as the animals we group together under the general name of corals.

Returning to the point from which I set out, nothing can prove more strikingly the difficulties as to the origin of coral-reefs than the comparison of Christmas Island as described so clearly and graphically by Mr. Andrews, and Funafuti as made known by the exploration of those other observers. In Christmas Island we have volcanic rocks coated over with masses of coral, and igneous rocks everywhere interlaminated with limestone; while in Funafuti, which we now know to a depth of 1000 feet from the surface, and of which we have most extraordinary and interesting borings in the centre of the lagoon, there is no volcanic rock whatever, but limestone of wonderful purity, with no foreign materials whatever, and the remains of calcareous skeletons of plants and animals. Here we have two utterly contrasted cases. I will say nothing on the vexed question as to the origin of coral-reefs, but I am prepared to anticipate with the very greatest confidence that the working out of the materials collected by Mr. Andrews in the raised reefs of Christmas Island, similar materials being collected by Dr. A. Agassiz in the Fiji Islands raised reefs, and the comparison of those with the materials obtained in the boring at Funafuti, if they do not settle the vexed question, will teach us for the first time what coral-reefs, and atolls especially, are, and will throw much new light on the important problem of the origin of these most wonderful structures.

Dr. Woodward: I think I shall be consulting the feelings of the meeting most by saying as few words as possible. We all must regret the absence of Sir John Murray, because to him we owe the inception of the expedition which has led to this very important paper which has been contributed to the Royal Geographical Society by Mr. Andrews. The work which he has accomplished was concluded in ten months, and is a thing which one may be very proud of, as a specimen of good results achieved in a short time by a naturalist from the British Museum. I, for one, am very proud indeed to be associated with Mr. Andrews. He has brought home over two thousand specimens, besides a large collection of plants, and, as Prof. Judd has pointed out, has given us most admirable geological information about the structure of coral-reefs. His observations, I think, if properly and carefully worked out, ought to furnish information just as valuable as the deep boring at Funafuti. I believe that Mr. Andrews will be able to show that these successively elevated terraces above the present reef on the margin of Christmas Island are as important a contribution to our knowledge of the structure and origin of coral reefs as a deep boring through a sunken atoll.

The collection of animals has extreme interest for the naturalist, on account of the remarkable fact that this island is nearly 200 miles distant from the nearest land, Java, so that it stands out in mid-ocean, in very deep water, and yet contains as many as five indigenous mammals, several birds, and a very large collection of invertebrata. Among the interesting living invertebrates it is remarkable to find a number of earth-worms, because we know that the transfer of earth-worms to distant points in the middle of the ocean, surrounded by deep water, must be a very exceptional thing, and must have occurred at a very distant period of time. So one may look upon this island as a most ancient geological point on the surface of the Earth; and all the plants and animals that are indigenous must be treasured up as of great scientific importance. The large collection of insects has not even been touched upon, and that we hope will, when worked out, prove quite as interesting as the higher forms of life found on the island. I can only congratulate Mr. Andrews on the interesting paper he has brought before us.

Mr. **George Murray** said that, having had some small influence in the selection of Mr. Andrews for the exploration of Christmas island, it was a particular satisfaction to him to listen to his account of admirable work—to an account both modest and lucid, as became so thoroughgoing a student of science as Mr. Andrews. With regard to the flora of Christmas island, it had previously been examined by Mr. J. J. Lister and the officers of H.M.S. *Egeria*, who had published in the *Journal of the Linnean Society* for 1890 a record of fifty-five flowering plants and seventeen vascular cryptogams. Mr. H. N. Ridley had landed on the island, and given a brief survey of his observations in the *Journal of the Straits Branch of the Asiatic Society* for 1891. On this material it was possible to reach a provisional opinion that, as in Java there was no distinctly Australian element, while, as Prof. Oliver has mentioned in his report, most of the plants could not be exactly matched with their congeners from Java, but yet varied insufficiently to be specifically distinguished—an indication of considerable age of the island's flora. It was, therefore, a case for the most careful collecting and for the closest scrutiny in working out the collections. Owing to the fact that many of the Malayan type specimens are in Leyden, this will take some time to do with justice, but he ventured to give the results up to now, together with the most modest forecast. About forty species of Polypetalæ have been determined by Mr. Edmund Baker, perhaps representing one-third of the total flowering plants. Among them there are a few entirely new and other interesting forms, while the cryptogams will probably yield a higher proportion. In any case, Mr. Andrews has collected the material for a florula of Christmas island, which will enable us to gain an idea of this botanically unspoiled oceanic island. To come to a practical matter, the valuable timber known as teak on the island has been botanically identified as *Berrya ammonilla*, belonging to *Tiliaceæ*, and, therefore, no true teak in the strict sense, though undoubtedly a valuable wood. He congratulated Mr. Andrews and the Society on the excellent record submitted to them.

Major **Darwin**: The speakers to-night have wisely avoided entering into the thorny question of the theory of coral reefs, and I am not the man to do so. No doubt it will be very interesting to discover *which* is the right theory; but I think the real thing to be hoped for is that *some* true theory will be found. What we want is to get a real clue to the evolution of different islands. I think Bacon spoke some of the truest words ever uttered, when he said, "Truth comes sooner out of error than out of ignorance." A man who makes a theory does good even if that theory turns out to be wrong, because it is the first step to find out what is right. So far as I can judge, there will be found to be a great deal of truth in both the theories. I think the matter is of exceeding complexity, and no one theory can account for everything. My father was a human being, and I am sure he would have been somewhat annoyed to find he was wrong; but if he had found himself wrong and Sir John Murray right, he, I am certain, would have been the first to congratulate him heartily. I also am a human being, and I cannot help hoping that my father will prove to be right after all.

The **President**: We have listened to a very fascinating paper, I think we may add an exhaustive paper, and one which shows that the author has gone through a great deal of severe work in his researches. There appear to be two ways of examining an atoll—one is by getting hold of it when under the water and by making holes in it, and that no doubt involves a great deal of work and deep-sea sounding, and I have heard from one or two of the young officers employed on the work that it is almost harder than they like; the other way is by getting hold of it when it has been raised 800 feet above the sea, and that method was adopted by our friend here, Mr. Andrews. When comparing the two kinds of work at Christmas island and at Funafuti, I am disposed to think that, considering that he had no assistance except a young lad, Mr. Andrews's work shows much greater labour than the other, where a number of officers and scientific men are engaged. I must express my admiration for Mr. Andrews at the way in which he has forced a road through this densely matted tangle of underwood, and over the jagged limestone reefs, in order to make a thorough examination of the higher plateau of Christmas Island. It is with very great pleasure that I propose to you a vote of thanks to Mr. Andrews for his most interesting paper, and for the illustrations which accompanied it. I think you will like also to express your thanks to Sir John Murray for having organized this expedition, and also Mr. Ross and his family for the great facilities and hospitality shown to our friend.

IN THE VALLEY OF THE ORINOCO.*

By Major STANLEY PATERSON.

The excitement caused by the dispute regarding the boundary between our colony of British Guiana and Venezuela turned the eyes of many in the direction of that Republic, and procured for it a temporary notoriety that in the ordinary course of events it might never have known.

Whilst this excitement was at its highest, I happened to be casually travelling in the West, and naturally directed my attention to the country of the moment, which I then for the first time discovered was practically less known to science than is Central Africa. The time at my disposal did not admit of any protracted journey on that occasion, but I made careful notes with a view to organizing at some later period a small expedition for the purpose of exploring the southern limits of the Orinoco valley, undoubtedly the richest and most fertile portion of the country. In the autumn of 1897 I was fortunate in obtaining six months' special exploring leave; so, hastily collecting sufficient kit, I sailed at once for Ciudad Bolivar, the main town on the Orinoco, and practically the western outpost of civilization in that district. At this time Bolivar, which is an old Spanish-built town, the capital of Spanish Guiana, was in a slightly disturbed state.

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* Map, p. 104.

From Bolivar, the farthest limit of regular steam traffic, we chartered a river steamer to carry the expedition to the small village of Caicara, which had been selected as the most suitable base of operations, my idea being to ascend the Cuchivero river to its source, explore the reputed wonderful mountain of Icutu, cross the Sierra Guamapi to the head waters of the Maniapare, descending by that river and the Ventuario to San Fernando de Atibapo. In this way the expedition would pass through entirely unexplored country, and connect the tracks of two famous explorers, Humboldt and Schomburgk. From Caicara we rode leisurely to Lajitas, on the Cuchivero, the most southerly spot in the district inhabited by Venezuelans or "rationales," as they call themselves in contradistinction to the "indigenos," or Indians.

These up-country Venezuelans, while boasting of pure Spanish descent, are all freely intermixed with negroes or Indians, frequently with both, and are quite a distinct and characteristic race. They are practically divided into three classes—the ato-holders, or small farmers; the canuqua men, or squatters; and the peons, or labourers. Each class looks down on that below it, but the distinction between them is one of degree only, the general character of all being identical, and, to our practical British minds, extremely paradoxical. All are avaricious, thriftless, independent, faithless, untruthful, lazy, capable of hard work, quick tempered, vindictive, changeful, and full of laughter. Life, partly by their own fault, is hard with them; penury is their abiding condition; they daily live on the verge of starvation, frequently for lack of energy to hunt for food. But, as their actual wants are few, this seldom saddens them—they look on the whole thing as a vast joke. If there are clouds, these children of the sun see them not; nothing is really serious to them; poverty, starvation, and death only seem part of the natural order of things, and even these have their jocular side. But this very sunniness, childishness, and irresponsibility that makes these people in a way attractive and interesting, also makes them terribly hard people for the energetic European to work with, and undoubtedly the majority of the troubles that befell our expedition are traceable to our failure to comprehend these peculiarities of temperament amongst our followers, and to grasp the leisurely and somewhat futile method of their working.

The track from Caicara to Lajitas leads across the wide savannah belt that forms the basin of the Orinoco. This undulating savannah, constantly broken by outcrops of water-worn ironstone rock frequently piled into hillocks 300 feet high, is covered with a luxurious pasturage, chiefly of rich guinea grass, on which numerous cattle of an excellent quality are reared, and is thickly studded with bushes of sweet-smelling chaparral, while in the marshier places long lines of waving moriche palms stand like bonneted sentries across the plain. The rocky "morros," or hills, are overgrown by innumerable creepers, flowering shrubs, and forest trees, amongst them the sarrapia from which the tonca bean is collected, and which gives to these hills their local name of "sarrapiales."

Naturally grass fires are common in this savannah land, and it is curious to see, during the progress of one, the crowds of long-tailed scissor birds hovering round the edge of the flame, and eagerly swallowing the smoke-stupefied insects, while on every bush or tree sits some member of the eagle or falcon tribe, intently watching for the frightened rush of some escaping small quadruped. These grass fires arise and pass quickly. After spending a whole day at Lajitas in carefully measuring and marking out a base for survey, I returned next morning to find that a fire had passed over the district, and my marks were beyond recognition. All across this savannah region the compass was practically useless for surveying purposes, owing to the quantity of iron in the rocks. At one time I found an error of 43°.

At Lajitas the *personnel* of the expedition was completed, and it now consisted of Diedrich Capellen, an enormously powerful Norwegian sailor and miner; a negro cook; twelve Venezuelans headed by one Nuñez, the chief man of the district; and myself. After the usual difficulties, caused by the unreadiness of our Venezuelan followers, we started in a large curiara, or dug-out canoe, up the Cuchivero river, here a swift-flowing stream about 200 yards in width, with high, rotten mud banks on either side, flanked by a wide belt of well-nigh impassable forest. Every few miles we came to a rapid, or "raudal," and, though all of these, with the exception of the raudal Seriapo, can be shot coming down-stream, we were forced to make a portage over them on the upward journey; hence progress was slow, and it was four days ere we reached the Caño Quebradaonda, where we took to the mountains in order to explore a lake called Laguna de la Vaca, of which our followers told many wonderful tales. We had now left the savannahs far behind, and were well in the heart of the Cerro Cuchivero, a continuation of the great range of Sierra Guamapi.

With the exception of two of our followers, half-caste Indians from Lajitas, no Venezuelans have previously penetrated this district, the "rationale" living in holy terror of the wild Indian tribes who roam through this otherwise unpopulated country.

This march to the Laguna was our first real experience of South American mountain-forest travelling, and a very trying one it was. Over the curiously piled rocks is spread a carpeting of trailing plants that entirely conceals the treacherous holes and crannies between them, so we were soon severely bruised by constant falls, and scratched and riddled with the spikes and spines with which every plant in the country seems to be abundantly provided. Overhead the sky was hidden by the dense foliage of tall forest trees, so laced together by lianas and other creepers that only by the constant use of the ubiquitous machete could we force a foot of way.

Not a breath of air stirred in this forest land, and the closeness of the atmosphere became at times almost unbearable, so great was the relief when, after three days' hard work, we emerged on the marshy banks of the laguna. Beyond that it is undoubtedly very deep and blocks a pass 2000 feet above sea-level, between the mountains of La Vaca and La Tor, whose precipitous sides of red rock rise straight from the water's edge on either hand, we saw nothing remarkable about this laguna, which is not more than half a mile in length by a quarter of a mile in width, and is venerated by the Indians as the abode of a curiously malignant spirit.

Another day's cutting brought us back to the river in a fairly famished condition, as our small stock of provisions had given out on the morning of the third day, and, as no game could be found, we had done two days' work on empty stomachs. On the river we soon found the canoe which had been sent on in charge of four men, and continued our southward journey to the raudal Alto, beyond which point navigation is impossible, the Cuchivero here becoming simply a mountain torrent. At the Alto we halted for three days to redistribute our stores, taking with us only the actual necessaries of life made up into loads of about 20 lbs., which, in addition to blanket, hammock, and rifle, was as much as our men could or would carry. The curiara and superfluous articles were hidden in the forest.

Although we had already seen traces of Indians, we had not so far encountered them; but, being now well within the limits of their territory, were constantly on the alert—fortunately so, for during the last night we spent at the Alto some of them attempted to creep into camp, doubtless to loot, but disappeared hurriedly when the alarm was given. The east side of the river is inhabited by the Taparitos, and the west by the Panares, both wild nomad tribes of no great reputation according to the frontier Venezuelans, who say that the former are fierce and treacherous robbers, and the latter lazy, sneaking thieves. Both tribes live indiscriminately under rocks or trees, and move about in search of their food, which chiefly consists of parrots, monkeys, and lizards. From the glimpse I afterwards had of them, they seemed of the usual South American type—squat, powerful, and absolutely naked.

From the Alto, which by aneroid and hypsometric barometer readings I made about 1900 feet above sea-level, we again faced the terrible mountain work, keeping along the ridges as much as possible to avoid the almost impassable caños and ravines near the water's edge. The trees here were much smaller than in the lower ranges, but the undergrowth was, if anything, even more dense, except when we suddenly emerged on an open slope of bare rock. On such occasions the view was magnificent, mountain upon mountain rising before us in increasing height and decreasing gradation of colouring, till the background was blocked by the lofty blue peaks of the Sierra Guamapi and the towering summit of great Icutu. This extraordinary mountain, as yet unvisited, and possibly unseen, by any other white man (nowhere can I find an account of it), is, according to my calculation, just 11,000 feet high, the base being about 2500 feet above sea-level. The sides slope steeply upward for 8000 feet, when they suddenly bulge outwards, giving the top the appearance of a gigantic button mushroom. The Taparitos, who consider this mountain sacred, say that no man can ascend it, consequently the Great Spirit lives there undisturbed. Unfortunately, the views I took of Icutu shared a common fate with the majority of my photographs, all being ruined by the unavoidable exposure to heat and damp entailed by this journey.

The difficulties of this march along the mountains were enormous, an actual advance of 4 or 5 miles forming a good day's work, as frequently, after cutting for hours towards some particular pass or bare spot, we found the way barred by a precipitous ravine or caño which took hours again to cut round. Food, too, was very short, a little rice and cassava being all we were able to carry with us. I had confidently relied on meeting plenty of deer, pig, and smaller game in this undisturbed region; but, strange to say, the upper Cuchivero seemed almost devoid of life of any description, and, with the exception of an occasional parrot, not an atom of meat had we been able to procure since leaving Lajitas. Then the Indians appeared—only a few of them so far as I could discern, though our men, whose fears were rising rapidly, declared they were in large numbers—and, after threateningly shaking their weapons at us, vanished quickly, only to reappear on the next ridge in our line of advance.

By this time the Venezuelans of the party, tired of short commons and sated with hard work, were grumbling audibly, declaring we must turn back, else we should all be murdered. We, of course, would allow no talk of retreat, and with difficulty kept the men going till after another severe wrangle, when, while I was cutting the way ahead, they all bolted back, taking their bundles with them. For some hours I went on alone, but, being joined by Capellen and the negro, who refused to leave me, and recognizing the futility of further advance without food, we three made for the river, and tediously cut our way back to the Alto, where we arrived unmolested by the Indians, but half starved, to find the runaways just launching the canoe. Several attempts were made to induce them to face the mountains again, but, these proving unavailing, there was nothing left but to return slowly to Lajitas, where we discharged all Venezuelans without payment on account of their breach of contract. To this they replied by instituting a strict boycott, so that we could neither procure food to eat nor canoes or donkeys to transport baggage. Then they tried to frighten us by swearing information before the civil magistrate—our own late headman Nunez!—that we were revolutionary agents, the proof being that we had carried so many rifles up country to arm the natives (?) (I had armed the party with Winchesters); and, further, that on one occasion I had refused to camp on the side of the river belonging to General Crespo, and had insisted on crossing to the bank belonging to an exiled revolutionary officer! This was quite true, as that bank contained some rocks I wished to investigate.

Cuchinero River.
El Negro.
Icutu.
ICUTU AND DISTRICT.

Eight days of this childishness tired us, so one night we swam the river, appropriated a curiara that was lying some miles down the opposite bank, loaded up our baggage, and were off before daylight on a wearisome journey to Caicara by river. On the lower Cuchivero we were able to kill plenty of game, so had no further anxiety about food, and Caicara was reached in due time without misadventure. The time at my disposal not admitting of another serious attempt to penetrate the mountain forests, I now decided on a small expedition by way of the Tortuga river to the country of the Colorado Indians, a semi-civilized tribe living just beyond the Serrania Cerbatana, in order to discover the feasibility of reaching the Sierra Guamapi by that route. Men of the right stamp for our work were, however, hard to find, and several days had to be spent hunting the country round Caicara before we succeeded in obtaining the requisite number.

Caicara, an uninteresting little village which has seen better days, is now the centre of the tonca bean industry on the Orinoco, and also does a fair trade in hides with many neighbouring atos and ranches. It boasts of a "plaza," a couple of dozen "adobe" houses, and a large church now closed, there being no resident priest, because, as the villagers themselves say, they are too wicked to have need of one! The remaining houses in the village are of the ordinary country thatched-shed kind, and the entire population is probably about 400. I make the latitude of the plaza about 7° 43′ N., and the longitude 66° 32′ W., which places it about 5 miles further west than it is ordinarily marked on the maps.

Just 10 miles to the westward the mighty Orinoco suddenly and—as the land to the north is a dead flat—most unexpectedly trends due east, and, sweeping in great volume round Caicara hill, forms a natural backwater affording excellent anchorage for boats and river steamers. Steamers of 4 feet draught can navigate the river as far as Caicara at any time of year, and in the summer or rainy season, when the river rises, as it does, 25 to 30 feet above winter-level, the way is open right up to the rapids at Perico, 200 miles further up-stream, as well as up the Apure, Meta, and numerous other tributaries. It is therefore obvious that Caicara has the makings of an important trade centre, and this it would doubtless already have become but for the inertness and want of enterprise of the Venezuelans. Our journey up the Tortuga, which is more of a creek than a river, was uneventful, except that, after ascending it for 20 miles, we found there was too little water to float the curiara, and had to take to the forest, here mainly composed of ironwood trees, very gloomy, but comparatively easy to traverse. The rocky slopes of the Cerbatana overtaxed the carrying powers of our men, and again we had to return slowly to Caicara, exploring much of the surrounding country during the down-stream journey.

The Tortuga takes its name from the numerous river-turtles that congregate in it during the months of March and April, the long shelving "barrancas" or sandbanks at its mouth being one of their favourite nesting-places. At this time canoe-loads of natives come from all parts of the river to collect eggs, and annually thousands of wretched turtles, worn out by the act of maternity and too weak to move, are slaughtered for the sake of their shells, which are freely used as basins and cooking-pots in every Venezuelan household. This river is also the haunt of myriads of birds of all descriptions, great and small, many of them quite unknown to me, and a short sojourn on its banks would, I believe, well repay a collector.

Throughout the entire Orinoco valley, orchids—chiefly, to be sure, of fairly well-known varieties—flourish in great beauty and abundance, and it is surprising that no enthusiastic hunter has yet reached the fastnesses of the upper Cuchivero in search of rarities. One, a German, the only white man, so far as I can learn, who has preceded me on the Cuchivero, did get as far as the raudal Piñal some fourteen years ago, but returned suddenly, for what reason the natives could not tell me.

From a commercial point of view, this country should be of great value. The rich rolling savannahs will rear countless herds of cattle and horses. The surrounding forests yield large quantities of natural products, such as rubber, copaiba, quinine, simaruba, and other drugs. The forest trees are of magnificent growth and endless variety. In the Cuchivero valley we saw mahogany, cedar, copaiba, simaruba, three species of hevea (*braziliensis*, *sprucii*, and *pauciflora*, I believe), castilloa, quina or cinchona of two varieties, red and yellow, numerous different trees belonging to the Ficus family, and many others unknown to me, or only known by their native names. The upper waters of the Guaniamo are so affected by the sarsaparilla that grows profusely along the banks, that the natives drink the water and bathe there, in order to cure themselves of skin diseases, to which they are peculiarly liable.

Traces of gold, silver, and cinnabar are to be found in the mountains, but, from the peculiar formation of the rocks, I doubt the existence of these metals in anything like paying quantities.

The fauna of the country is in all respects similar to that usually found in the northern states of South America. The jaguar and ounce (*Felis onca*), classed as one in most natural history books, but always treated as separate animals by the natives, infest the dense forests, and are held in great dread by the country people, several of whom annually fall victims to these fierce marauders. We met two hardy brothers who went about killing these animals, one armed with an old gun loaded with nails, and the other with spear and machete. Their *modus operandi* was to track the animal till he was sighted, when the brother with the gun treated him to a dose of broken iron, the other brother meeting the immediately induced charge on the point of his spear; then both quickly despatched the impaled quarry with the ever-ready machete. These men had just killed a magnificent animal when we encountered them. The puma, which frequents the hills, is considered a coward, and is consequently little feared. The steamy jungles by the river-banks are the haunt of the great grey tapir, the harmless capybara, or water-hog, and that truculent little pig the collared peccary. Morning and evening hundreds of deer (*Cervus savannensis*) emerge from the forest shade to feed on the sweet savannah grass; but these little fellows are extremely wary and difficult to get at. Monkeys are few and far between, possibly because they are so killed down by the Indians for food. In the rivers are a fair number of manatee, and while peacefully floating down-stream, one is frequently startled by the strange hissing snort of the giant otter (*Lutra braziliensis*), an animal quite four times the size of his English prototype. We captured a pair of pups—quaint, noisy little chaps, which lived in camp with us for many weeks and became quite tame. Unfortunately, both died suddenly on board ship, much to my regret, as I hoped to bring them home alive.

Bird life, as I have already said, is most abundant, the poverty-stricken squatter having a hard battle to save his fruit and corn from the incessant attacks of these winged robbers. Snakes are plentiful, chiefly boas and a very poisonous species called by the natives "mapanaré." These snakes usually lie coiled up on the branches overhanging the river, and strike quickly downward at anything passing beneath. We had the curious experience of killing seven great boas, lying all together, the largest measuring 20 feet 8 inches, and the smallest 12 feet 9 inches in length. Alligators, many of enormous size, iguanos, and lizards are everywhere.

The Orinoco is full of fish of many varieties, amongst them the "valenton," a kind of tarpon, the voracious carib fish, electric eels of great size, and a curious fish called "paillara," somewhat resembling a salmon, but with large tusks working through callosities in the nostril, and a fearsome row of teeth behind them.

This part of Venezuela teems with insects, especially of those kinds most disturbing to the peace of man. Mosquitoes, sandflies, and a small stinging beetle make life a burden to the new-comer, who, try as he may, can find no effective means of eluding them. Every step in the unburnt savannah covers one with grass-ticks, and an occasional tender tickling about the toes suggests that a friendly jigger has ensconced himself comfortably beneath one's skin, only to be ejected by ultimate unpleasant carving.

There are but two seasons in Venezuela—the wet, lasting from about the middle of April till the first week of September, and the dry. In the latter season the climate is far from unhealthy, and, except when the easterly breeze drops, the temperature is not unduly warm. This easterly breeze is the saviour of the Orinoco valley. Every morning, about four o'clock, the leaves begin to rustle, and soon the trees are swaying and creaking in the freshening wind—sometimes half a gale—that sweeps away the swamp mists, searches out and dries up the heaps of reeking vegetation, and generally acts as a great purifier till about eleven o'clock, when it suddenly dies away, and the sun beats down in all his fierce heat on river, plain, and forest. Then the world goes to sleep; not a leaf stirs, not a sound is heard, not a living creature moves, unless it be some tireless, persistent and perspiring Briton, who refuses to time his incomings and his outgoings according to the great clock of Nature. At two o'clock another whisper runs through the trees, and again the sweetening wind brings life back to the forest, continuing to blow strongly all afternoon, till it sinks to rest with the sun behind the fiery western clouds.

During the winter months there is but little rain—we had only three wet days in fourteen weeks—but the constant night dews are sufficient to soak through blankets and clothing, and make every one cross, stiff, and unhappy by morning time. Once or twice the cold at night was too great to permit of sleep in such light covering as we were able to carry, and the night had to be spent by all of us cowering round the camp fire. The appended table shows the approximate temperature at various stages of our journey. For lack of proper instruments, I was unable to register the humidity of the atmosphere, which was considerable.

Apparently no relics of any previous civilization exist in this part of the country, nor, with the exception of two deeply cut circles on the rocks in the middle of the river both at the raudal Seriapo and the raudal Alto, could we find any trace of Indian carving or picture-writing. On the Tortuga we discovered the remains of an ancient village, which had evidently been built out on piles over the river, whose bed—almost dry at the time of our visit—was thickly strewn with fragments of broken pottery, mostly bearing quaint and well-formed designs. Their age is not easily determined, but, as the Indians in the district have now lost the art of making pottery, they are probably of considerable antiquity.

Contrary to expectation, we found the people all over the Orinoco valley most friendly to the English, whose business qualities they respect, and disposed to view the boundary difficulty as merely a question of brag, out of which their own politicians, whom they distrust, hope to aggrandize themselves in some unexplained way.

I am fully convinced that this valley will one day develop into one of the richest commercial centres in the West, but its development requires capital, and English capital is naturally shy of entering the country in the present unsettled state of affairs.

APPENDIX I.

Average Temperature as taken by Special Travelling Thermometers, Kew Nos.

Approximate altitude in feet.	Place.	Average.		Highest maximum reading.	Lowest minimum reading.	Remarks.
		Maximum.	Minimum.			
800 to 1100	Savannahs	87° 20′	75° 10′	88° 40′	73° 0′	* A specially cold night at the highest altitude we reached.
1100 to 1900	Cuchivero river	85° 30′	72° 0′	88° 0′	69° 0′	
1900 to 2600	Cerro de Cuchivero	82° 20′	61° 0′	87° 20′	54° 0′ *	

APPENDIX II.

(a) Approximate Heights of Principal Camps.

Camp.	Height in feet above sea-level.	Remarks.
Caicara	800	Calculated from the mean of aneroid and hypsometric barometer readings.
Lajitas	1300	
Raudal Alto	1900	

(b) Approximate Heights of Principal Mountain Peaks.

Mountain.	Height in feet above sea-level.	Remarks.
Anapui	3,200	Calculated trigonometrically from above camps.
Quebradonda	2,900	
El Negro	4,000	
San Vicenti	2,400	* Three mountains above the Alto so named by us on account of the similarity of their appearance.
Los tres Hermanos * ...	4,300	
Icutu	11,000	

NOTES ON THE MAP.

The map is framed on a combination of—

(1) Plane-table survey.
(2) Prismatic-compass survey.
(3) Astronomical survey.

The entire land work was done by plane-table, the compass proving unreliable, owing to the amount of ironstone in the rocks. The original base was carefully measured along the river-bank at Caicara, and from this the point of Caicara island was fixed. This new base, Caicara—point of Caicara island—became the primary base of the survey. Subsidiary bases at Vainas, Bucaral, and Lajitas were interpolated from mountain peaks already fixed. As, however, it was seldom possible to fix identically the same spot on these mountain-tops, some slight error may in this way have crept into the work.

A new base was formed at Lajitas by measurement and extension—the ground being too rough to measure correctly a sufficiently long base for the work—and a subsidiary base was interpolated at the raudal Alto. Later subsidiary check bases were interpolated at Punta Capuchino and Laguna de la Guaya; more, possibly, by good fortune than by good guidance, these checks worked out with wonderful accuracy.

The river work was done by prismatic compass and time survey, and is necessarily somewhat inaccurate, the varying strength of the current and the somewhat intermittent work of the paddlers making it extremely difficult to gauge with any degree of accuracy the real distance travelled. The compass also seems to have been affected by the ironstone, as was the case on land. The points fixed astronomically were—

Caicara.—Latitude by meridian altitude of sun, 7° 43′ N.; longitude by morning sights (sun), 66° 32′ W.

Lajitas.—Latitude by meridian altitude of sun, 66° 55′ 8″ N.; longitude by chronometer and four altitudes of Aldebaran, 66° 15′ 18″ W.

Randal Alto.—Latitude by sun, 6° 31′ 30″ N.; longitude by chronometer and sun, 66° 16′ 8″ W.

Mouth of Cuchivero.—Longitude by chronometer and altitude of Procyon,

Punta Capuchino.—Latitude by sun meridian, 7° 39′ 32″ N.

Mouth of Tortuga.—Latitude by sun meridian, 7° 16′ N.; longitude by morning sun and chronometer, 66° 56′ 16″ W., 66° 13′ 40″ W.

Owing to want of practice and experience in astronomical work, I am very doubtful as to the correctness of any of these observations, and, in placing these points on the map, have usually preferred to rely on the mechanical accuracy of the plane-table rather than on the more dubious results of inexperienced astronomical observation. The factors from which these results were obtained are attached hereto—at least, such as remain in my possession. Unfortunately, owing to the capsizing of a canoe in the Tortuga, the remainder were lost, though luckily the results of the calculations had been already committed to the map.

The entire work was completed under circumstances of considerable difficulty, as, except in the savannah country, the stars were rarely visible through the dense forest trees; all night work was rendered inaccurate, owing to the constant heavy dews, which dimmed the sextant glasses before contact could be obtained, and the continual interruption of work caused by the unbearable irritation from the bites of thousands of mosquitoes and other troublesome insects. I do not, therefore, claim that this is a complete and correct survey, but consider that it is nearly so, and much more accurate than any of the antique existing maps.

THE PROCEEDINGS OF THE PAMIR BOUNDARY COMMISSION.

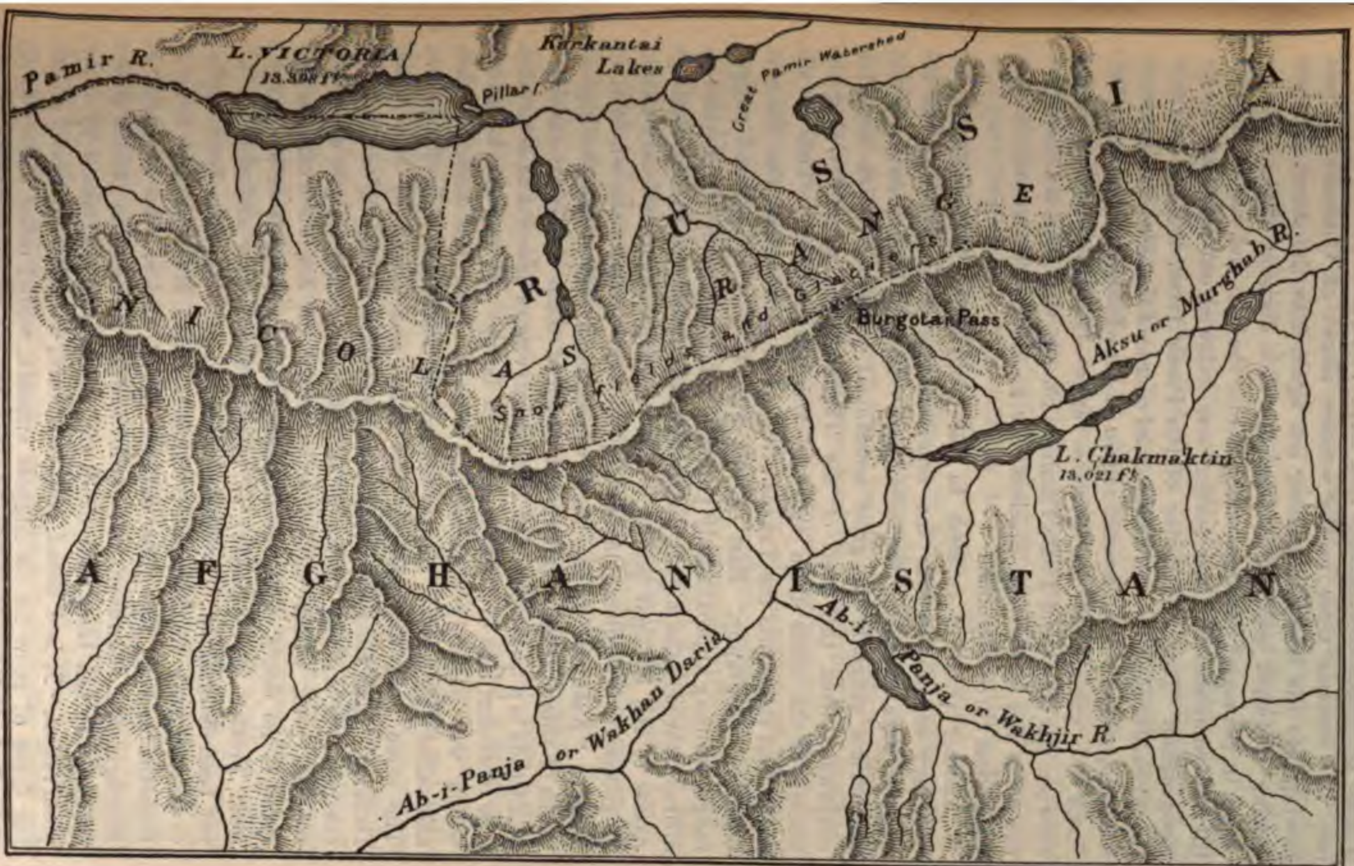
The report on the Commission for delimitating the Russo-Afghan Boundary on the Pamirs has at length been given to the public. This commission left India in June, 1895, and returned in October of the same year, so that the report is about three years old.

It contains an account, by Major-General M. G. Gerard, of the arrangements preliminary to delimitation, and of his journey subsequent to the completion of the boundary through Russian Central Asia to Europe. The narrative of proceedings during delimitation has been written by Colonel Holdich, R.E., together with the historical and geographical notes of the Pamir region. The survey report is by Lieut.-Colonel Wahab, R.E., and the natural history section by Surgeon-Captain A. W. Alcock. The last is both interesting and valuable, and (in common with the rest of the report) is excellently well illustrated; but it is to the geographical sections of the report that we wish to call attention at present, as they appear to throw fresh light on certain debatable points in Central Asian geography, and to clear away the mists that have hung so long around the sources of the Oxus.

The first pillar of the boundary was set up at the eastern end of Lake Victoria, and this point was selected, together with one near the end of the demarcated line, for comparison between the Russian and English values in latitude, longitude, and altitude, to serve as the datum, or basis, for all the surrounding survey. The results of the comparison are given by Colonel Wahab, and they are certainly satisfactory; for they exhibit no divergence of opinion whatever as regards longitude; only a small one in latitude; and none to speak of in altitude. In fact, the Russian mapping of these regions is entirely in harmony with the Indian mapping, and it may safely be assumed in future that Russian values are practically identical with our own. The longitude agreement is of special interest when we consider how it was obtained. Direct geodetic triangulation connects the western shores of the Caspian sea with Greenwich—some 2200 miles—across the intervening states of Europe. Here for the present it ends, and the Russian longitudes of their Central Asian possessions to the east of the Caspian depend upon telegraphic determinations only. For about another 1000 miles from the Caspian to their military post of Osh the telegraph is thus responsible, and Osh was, two years ago, the nearest point so fixed relatively to the scene of demarcation on the Pamirs. From Osh to the boundary-line (about 80 miles) the longitude values were brought down by chronometric deduction, a very fine battery of chronometers being carried in circuits till it touched the field of operations.

On the English side, the longitude of India is derived from Greenwich by telegraphic determinations, and the longitude of the Lake Victoria pillar was derived from India by direct triangulation, which was carried from Gilgit across the Hindu Kush into the Pamirs. Although it was improbable in either case that any large absolute error should exist, it was quite possible that a difference might have been found on comparison of final results, which would be appreciable on the scale of mapping. It was, therefore, a matter of congratulation that the accordance should be as absolute as it proved to be when that comparison was made. Latitude was, of course, determined on the spot by means of astronomical observations; but the Indian Survey determination was additionally fortified by the value derived from triangulation, which agreed absolutely with the astronomical deduction. In altitude, again, there was little to adjust between the trigonometrical values and the barometric determinations of both Russian and English surveyors. We may safely assume that the Pamir altitudes are now definitely fixed.

The height of Lake Victoria was trigonometrically fixed at 13,390 feet above the sea, a result which is in agreement with the barometrical determinations of the Russians, and which differs from Captain Trotter's value (determined during the progress of the Forsyth Mission) by 560 feet. Trotter makes the altitude too great. His observations were made in the unsettled spring weather, when single barometric determinations are of little value. It is curious that Wood should make its altitude 15,600 feet in mid-winter by hypsometer observations. Lake Victoria is only 400 feet higher than Lake Chakmaktin (the "Gazkul" of the Little Pamir), and about 500 feet below the watershed of the Great Pamir. One principal source of the lake is an affluent 14 miles long which rises in the northern slopes of the valley, not far from the pass across the watershed leading eastwards to Jarti Gumbaz. This affluent, known as the Yangi Diwan, flows through two small lakes, each about half a mile square, lying close under the saddle of the watershed. The mountains enclosing the lake run to 5000 and 6000 feet above the water-level on the south, where they culminate in the vast glacial system of the Nicolas range dividing the Great and Little Pamirs; and to about 4000 feet on the north. There is another system of lakes which drain into Victoria, hidden in the northern slopes of the Nicolas range, through which immense volumes of glacial water pass down. There is, however, strong evidence that Lake Victoria is gradually silting up, and that it will in process of time cease to exist in its present form. Neither Lake Victoria, which long held its own as the reputed source of the Oxus, nor Lake Chakmaktin, which was for years its great rival as the source of the Aksu, can properly be called a source at all. Both of them appear to be but incidents in the construction of the water-channels of the Pamir river and the Aksu respectively. Of both of them it is said that they are fed by warm springs, but in neither case are these springs sufficiently apparent to justify the supposition that the lakes, rather than the glacial streams which feed them, are the fountain-head of the rivers to which they belong. There are several lakes above the level of Victoria, any one of which (except for the accident of size) might apparently claim equally with Victoria to represent a source. The confirmation of the upper drainage of the Chakmaktin is peculiar. Early explorers represented the lake as having two outlets—one eastward to the Aksu, and the other westward to the Ab-i-Panja. Later explorers maintained that the lake drained only to the eastward, and that it was the source of the Aksu-Murghab river only. Neither view is entirely correct, though the former perhaps more nearly approaches the truth than the latter; for the headwaters of the Aksu, which originate in the glaciers of the Nicolas range (which,



SKETCH OF SOURCES OF THE OXUS RIVER.

Scale about 8 miles = 1 inch.

it must be remembered, equally feed Lake Victoria on the north), divide into two streams close to the western shores of Chakmaktin, part flowing into the lake and passing out again into the Aksu, and part flowing westward into the Ab-i-Panja. This division of the drainage occurs in the marshy swamps which border the lake, and was unobserved till the complete drainage system was followed out in detail by the topographer. Thus the source of the Pamir river, and the source of the Aksu-Murghab, as well as the chief source of the Ab-i-Panja are *all* found together in that elevated region of snowfields and glaciers which forms the summit of the Nicolas range—the dividing watershed between the Great and Little Pamirs. Surely, then, the true source of the Oxus lies amid these glaciers; for no single affluent can compete with these three combined.

Another point of interest in the geographical researches of the boundary commission was the determination of the position of the highest peak north of the Himalaya. It will be remembered that the Sarikol range is the great meridional watershed which stretches northward from the head of the Tagdumbask Pamir, dividing the waters of the Oxus from those of the Tarim basin. This is the range that represents the Taurus of classical authors, and the Bolor of mediæval geography. East of this watershed is a high and rugged range, running approximately parallel to it, but topping the Sarikol in altitude, through the mighty gorges of which the eastern Sarikol drainage passes to the Kashgar plains. This range has been variously named by successive travellers. As a comprehensive name for the whole of it, perhaps "Kashgar" is the most appropriate. On it are the highest peaks of this northern region; but which of them claims pre-eminence in altitude is a question which Russian surveyors have yet to determine. The most northern of these peaks is in lat. 38° 35′, and this is the one which was probably observed by Trotter from the Kashgar plain and called Tagharma. Trotter determined its height to be 25,000 feet. The same peak was seen by Ney Elias, and named by him Mount Dufferin. The Russian maps, however, call it "Kangur," and this is the name it will be known by in future. Trotter assigns a position for the peak which throws some doubt on his observations, but there is no doubt that the Russian position (which differs largely from Trotter in longitude) is correct, though its altitude has not yet been determined. Trotter's height (25,000 feet) has been applied to another peak further south, which is called Mustagh Ata both by Russians and by the great explorer Sven Hedin, who ascended it. Mustagh Ata, however, now falls within the Indian triangulation system. It has been well fixed, and its height ascertained by direct observation. It is a broad, bold mountain, with a magnificent glittering dome of snow for its highest summit, whilst other more sharply defined pinnacles of less altitude support the dome on either side. The height of the dome is 23,480 feet, and the height of an outlying pinnacle 22,780 feet. It will be a matter of interest to learn, when the Russian trigonometrical survey closes on the boundary, whether Kangur or Mustagh Ata is to rank as the highest mountain north of the Himalaya.

Perhaps the most interesting of all the investigations connected with the Pamir boundary is that which traced out the ancient lines of communication with India. Those routes which lead directly from the Pamirs towards Chitral, Gilgit, and Kashmir have never yet been traversed by any military invading force moving southwards; neither have they been used by any of the countless irruptive hordes of Central Asia, seeking new countries and thirsting for the wealth of Hindustan, who have from time to time left the north-west borderlands of China and poured over the boundaries of India. The course of these irruptions can still be faintly traced in history, or be gathered from modern ethnographical evidence. This subject is dealt with in the historical section of the report, which points out that the only travellers through these most inhospitable regions who have left any authentic record behind them are the early Buddhist pilgrims, who made their way either alone or in small parties by the most direct route, in quest of the great centres of their faith which existed between the Hindu Kush and the Peshawar valley, east of the country of the Kafirs. Chitral, Dir, Gilgit, Darél (an almost unexplored district), and Swat were all under the influence of Buddhism till late in the Middle Ages.

These Chinese pilgrims, who set out from Northern China as scholars and returned as missionaries, seem to have explored every route in existence which led to the great Buddhist cities in Swat and the Kabul river valley. Fa Hian, who started about the year 400 A.D. from Kansu, crossed the desert of Gobi to Khotan. There he found a flourishing Buddhist community. From this point his route has been much discussed, but the topography of the districts between Khotan and India appears to decide it. He journeyed twenty-five days towards the country of Tseuho (rightly conjectured to be the Yarkand district), from which he says there is a caravan route due south into the mountain region of Tsungling. After a month he reached the country Kiesha, in the Tsungling mountains. Another month across these mountains brought him to Toli, which has been identified with the valley of Darél, south of Gilgit. After fifteen days' further advance towards the south-west, he struck the Indus, and, crossing it, he reached the kingdom of Udyana. If we accept Tseuho as identified with Yarkand, and Toli with Darél, there exists but one possible caravan route "southwards," by which Fa Hian could have travelled. This is the route which traverses the Hindu Kush by the Baroghél pass, the Baroghél having been a recognized caravan route through all ages. And there is no *known* route into Darél from the north, except that which passes through the Gilgit valley. But where is Kiesha? It seems possible that Kiesha, "in the centre of the Tsungling mountains," may have been Chitral, which is called also Kashkar. There is interesting evidence that Chitral was once Buddhist, and Fa Hian's graphic description of the place tallies well with what we now know of it. There is also the probability that so earnest a pilgrim as Fa Hian would endeavour to visit all Buddhist places that he could compass on his pilgrimage. After leaving Kiesha, he continued to wander amongst the mountains for a month, and he followed a road "where there is snow both in winter and summer;" where there are "poison dragons who spit poison; winds, rain, drifting sand, and gravel stones," and the people of that land are called "snowy mountain men." A climate such as this implies that his wanderings kept him in the northern hills and amongst high altitudes, and the topography of the country indicates that he followed the route to Gilgit, subsequently made famous by the march of Kelly's relief force. There are many evidences of the former vitality of Buddhism at Gilgit, especially about the narrow defiles and "durras" which lead to Darél. There are the remains of a stupa at Hunzil (about 10 miles from Gilgit), as well as rock-cut figures and inscriptions. About Darél itself we unfortunately know very little beyond what is contained in the report of a native surveyor, who traversed it in 1876. He describes its fertility and the growth of vines in the valley, but says nothing about Buddhist evidences. From Darél, Fa Hian's graphic description of the next fifteen days' journey along the Sintu-ho (Sindhu, or Indus), till he reaches the Udyana plains, leaves little doubt about the position of his final entry into India. Sung Yun, in 518 A.D., seems to have followed the same route. Hiuen Tsiang, in 630 A.D., followed the trade route from Northern China to Tashkent and India, and returned *viâ* the Pamirs.

Incidentally, the limits of the ancient kingdom of "Bolor" are traced out on the historical notes of the report; and there are references to the ancient Christian communities of Asia, and the survival amongst the Sarikolis and Kirghiz of fragments of Christian ritual in their ceremonies of to-day.

The grass highland valleys of the Pamirs are described, and the passes connecting them; but there is not much more to be said than has already been said by former travellers about the physical appearance of that elevated tableland. It has its picturesque aspects during the short summer season; but the empty desolation of those snow-covered wastes for the rest of the year drives even the hardy Kirghiz nomads to lower altitudes and more hospitable climes. They are occasionally visited by huntsmen in search of *Ovis Poli*, but are more usually left in silent desolation to the cold sweep of winter storms and the fierce grip of winter cold.

DEEP-SEA EXPLORATION OF THE EAST INDIAN ARCHIPELAGO.

THE Dutch Government has placed at the service of the scientific men of Holland the newly built man-of-war *Siboga*, 820 tons. She has been fitted out with a Le Blanc sounding apparatus, a small Lucas sounder, and also an electric cable-drum capable of holding 10 kilometres of steel cable. Besides the usual trawls and dredges, the zoological equipment includes all necessary apparatus for plankton, and littoral and deep-sea investigations; there are also meso-plankton nets of various construction on board, including those made use of by Tanner, Chun, Fowler, and others. For the physical investigation of the ocean the expedition is also fully equipped. A room in the forepart of the vessel has been fitted up as a laboratory.

The necessary money for the equipment and cost of the expedition has been supplied partly by Government, partly by learned societies, and partly from private sources. Their Majesties the Queen and Queen Emma have also given their help. The ship will be commanded by Captain G. F. Tydeman, who will have under him two other naval officers. The scientific leader of the expedition is Prof. Max Weber, who sailed on October 28 for India, *en route* for Surabaya, in Java, to take charge of the investigations. He is accompanied by his wife, Mevrouw Anna Weber van Bosse, who will study the algæ of the archipelago. His assistants are Dr. J. Versluys, Mr. H. F. Nierstrasz, and Dr. A. H. Schmidt. For several months past Prof. Weber has been engaged in fitting out his expedition, and has interviewed Sir John Murray, Prof. Chun, and others, both with reference to the outfit and to the nature of the work to be undertaken.

The object of the Dutch deep-sea expedition is the zoological, botanical, and physical investigation of the marine area of the East Indian archipelago, particularly of the deep basins of its eastern portion. The *Siboga* sailed from Amsterdam for Java on December 12. The work of the expedition will commence early this year, and the investigations are expected to extend over two years. The proposed route is as follows: Starting from Java, the different instruments and apparatus will be tested, and preliminary observations made, in the shallow water south of Madura. Then sailing east, attention will be directed to a region more than 1000 metres (550 fathoms) in depth, connected with the Indian ocean by the Lombok strait, which strait will be thoroughly examined down to the greatest depths. The course then lies along the Allas strait, where within a distance of 60 miles the water shoals from 4000 metres (2190 fathoms) to 100 metres (55 fathoms). Along this steep slope serial temperature and density observations will be taken. Thence the *Siboga* will proceed to the Postillon and Paternoster islands, the examination of which is desirable because they lie exactly on the supposed border-line between regions with and without true coral reefs. True coral reefs are apparently almost entirely confined to regions north and west of a line from Pontianak, in Borneo, and Riouw, and east of a line drawn along the east coast of Borneo from Cape Kamiangan to the southern point of Celebes, and thence to Bima, in Sumbawa. Within the region bounded by these lines (in contrast to the eastern portion of the archipelago) true coral reefs, if present at all, are poorly developed, or are found in a raised condition. An attempt will be made to ascertain the reason for this, and in this connection the distribution of the plankton will be carefully studied. From these islands the route will be continued to Bima, across a small basin in which soundings have shown a depth of 3900 metres (2130 fathoms). Possibly an examination of the bottom-fauna may throw light on the age of this basin, and show whether its origin has any connection with the eruption of Tamboro. Thence the route will be through the Sapie strait and along the west coast of Sumba for a distance of about 70 miles, the depth of water increasing from 40 metres (22 fathoms) down to the deep sea. Along this slope, as in the region south of Lombok, serial observations will be taken at various depths, and the nature of the fauna investigated. In order to arrive at more definite conclusions regarding the physical conditions of the ocean water, and the character of its fauna, the investigations will be continued south of Sumba, and then the expedition will cross the low ridge between Sumba and Savu, and penetrate into the deep basin between Flores and Timor. Thence the route lies over the ridge between Ombaai and Pulo-Kambing separating the Timor basin from the deep Banda sea. The temperature and other conditions in this sea, which is shut off from the Pacific and Indian oceans by high ridges, at least as far as the deeper waters are concerned, are well worthy of further research, which may assist in the solution of certain problems suggested by the *Challenger* and *Gazelle* observations. It is desirable to cross the boundary ridge of this deep basin at two other places for the sake of serial observations, viz. first between Dammar and Tjan, in the direction of Tenimber, and second about lat. 5° S. and long. 130° E., where the slope into the Banda sea must be very steep. After an extensive examination of the Banda sea, the voyage will be continued eastwards to the Aru and Ki islands. The *Challenger* observations have shown that the bottom in this neighbourhood is covered by an exceedingly rich benthonic fauna; thus two hauls of the trawl in 129 to 140 fathoms produced over four hundred specimens of marine invertebrates and fishes, belonging to about 167 species, of which no fewer than 132 species (or four-fifths of the total number) were new to science, including representatives of 32 new genera. Thence the route crosses the ridge between Buru and Ceram (Manipa strait), which is over 3000 metres (1640 fathoms) below the surface of the sea. Serial temperature and density observations will be taken during the passage from the Banda sea to the Ceram sea, as well as in the Ceram sea and eastwards from it, and especially in the Molucca strait west of Halmahera, with the view of solving the question as to the possible inflowing of deep water from the Pacific into the Moluccca strait. As this might occur between Halmahera and Talaut, the investigations (both physical and biological) will be continued from Talaut eastwards as far as long. 129° E., where the bottom of the Pacific attains a depth of 4000 metres (2190 fathoms), so that it will be possible to institute a comparison between the fauna of, and the physical conditions obtaining in, these different regions. Thence the expedition will sail northwards from Sangin into the Celebes sea, which will be crossed in several directions, thus making it possible to form an accurate idea of the outline of this deep basin, and the results may throw light on the age of the Celebes and Banda seas. During the further course through the Macassar strait, and especially in the southern portion, the quantity of plankton will be studied in connection with the abundance of fishes and the massive development of corals in the Spermonde archipelago. After such a careful examination of the deeper eastern seas, and the ridges separating them from each other and from the Pacific and Indian oceans, an increased interest will attach to the investigation of the shallow Java sea, and the peculiarities in the hydrography and fauna of the different basins will stand out in greater relief.

MAP OF THE SHIRE HIGHLAND DISTRICT OF BRITISH CENTRAL AFRICA.*

By ALFRED SHARPE, C.B.

THIS map has been compiled by the Survey Department of the Protectorate Administration. The bulk of the work has been done by the Indian Surveyors lent to the Protectorate by the Government of India, under the supervision of Mr. William Anderson, chief surveyor.

The greater part of the surveys has been carried out in connection with the delimitation of various estates claimed by and granted to Europeans. Where gaps occur between different surveyed blocks, these have been joined up by triangulation. The map represents three years' work.

The instruments used were, in the first instance, generously loaned by the Royal Geographical Society to the Protectorate; and but for their ready help, and for the constant assistance given by the Indian Government, we should have experienced many more difficulties in our work in British Central Africa than has been the case.

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* Map, p. 104.

A vast amount of survey work remains to be carried out in the Nyasa regions, and if our local Survey Department could deal with this for purely geographical purposes, we could doubtless more speedily arrive at interesting results. It is necessary, however, to take in hand a large quantity of work connected with ordinary sales of estates, purchases of crown land, etc.; and the endeavour is to join this in as much as possible with such other more general and interesting work as there is time for. The work of the Indian surveyors has been excellent. They soon get used to the Central African climate, and stand it better than Europeans; they are able to carry out work which would be hardly possible for Europeans in that country.

LAKE TRASIMENE.*

By Prof. PAUL CHAIX.

Lake Trasimene, of permanent historical interest, is a sheet of fresh water of 50 square miles in extent, not more than 12 feet in average depth, 10½ miles in length, and 6 miles in width, with an irregular shape measuring nearly 40 miles along its shores. It is surrounded with smiling, picturesque hills, studded with old castles and splendid olive groves, a salubrious tract in the natural condition of its waters. But they are deprived of any natural outlet, and find an inadequate discharge in a small, tortuous, and choked ditch, the construction of which is ascribed by some to Roman times, and by others to the famous Braccio da Montone, lord of Perugia, a rival of Attendolo (Francesco Sforza). That silted-up ditch was in no condition to allow a free discharge to the occasional deluges of rain collected by a basin of over 100 square miles of surface. The waters rose sometimes 9 feet above their average level, converting a belt of well-tilled land into unwholesome swamps. The fever-stricken and helpless inhabitants bore the scourge for centuries, without any relief from the Pontifical government, which imposed absurd regulations on navigation and fishing. The Italian government went so far as to grant a concession for the complete drainage of the beautiful lake to speculative adventurers, happily without the pecuniary means for carrying on the work.

The year 1875 having been marked by a flood of uncommon height and duration, patience was at an end amongst the surrounding population; a general meeting, convened by Cavaliero Guido Pompili, on September 24, 1877, resulted in the formation of a committee for the construction of a canal of proper size and slope. Cavaliero Guido

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* Consorzio del Trasimeno. Quadro Sinottico della sua Storia, 1875, 1898. Perugia, 1898.

Pompili was, notwithstanding his youth, called to the chair, and holds it to this day. The next two years were spent in the necessary measurement of depth, variations, volume of the lake, slope, and traverse of the intervening country to the basin of the Tiber. But the bill had to be carried through the slow discussions of all sorts of corporate bodies, provincial, sanitary, parochial, agrarian, etc., meeting everywhere with stupid opposition. It was, in 1891, submitted to the examination of three engineers of high standing, Brioschi, Cadolini, and Coletti, whose report, given in March, 1891, estimated the expense at 1,733,000 Ital. lire (£68,120), entirely borne by the committee. A royal decree was not, however, granted before July 14, 1895, authorizing the execution of the long-delayed work under a commission whose chairman was the sanguine and clever Cavaliero Guido Pompili, with several engineers, including Marquis Ruggiero di Sorbello and Count Francesco Conestabile.

The canal is, at its origin, 800 feet above the level of the sea, 30 feet broad, with sloping sides, discharging into a trapezoidal basin 48 feet long, and by a tunnel of elliptical section of 10 feet height, 11 feet width, and over 3000 feet in length, is carried under the hill and village of San Savino del Lago. At its outlet the waters are carried 800 feet through a walled reach, and lastly, by a trough over 3 miles long, to the little river Caina, a tributary of the Tiber.

The works were very briskly carried on, and ended in the opening the upper reach, a difficult matter in the swollen condition of the lake. The maximum discharge of the new canal being 12 cubic metres per second, it was calculated that twenty-four months would be required for the outflow of the 205,000,000 cubic metres, the volume of the waters above the new adopted level giving to agriculture 2470 acres of excellent land, and protecting an equal area against the swampy condition which had given a bad name to that country.

The works were completed on March 15, 1898, within two years, at an expense of 658,565 Ital. lire, instead of 1,733,000 given by the former official valuation. Soon afterwards the canal was submitted to engineering examination, and, on September 27th, 1898, solemnly opened in the presence of a part of the ministry, of many lukewarm authorities and of an immense and elated population.

PROF. SUPAN ON THE RAINFALL OF THE GLOBE.

By A. J. HERBERTSON.

The necessity for accurate knowledge of rainfall in agricultural, engineering, and other practical problems, has led to a great extension of the number of rainfall stations in recent years, and sufficient data have now accumulated to warrant the construction of new rainfall maps. Prof. Supan in Germany, and the writer in this country, have independently undertaken the task. Prof. Supan has recently issued two important papers dealing with the annual distribution of rainfall over land and sea, and with the seasonal distribution and annual range of precipitation over the land, and giving rainfall tables as well as rainfall maps.*

In selecting the data, Dr. Supan has overlooked two important works, Prof. Wild's newer means for stations in the Russian Empire, published in 1895, and Dr. Angot's tables for Western and Central Europe, where the means are reduced to a uniform thirty-year period. On the other hand, he has made use of Mr. Eliot's data, published in the Indian *Annual Summary* for 1896, and noted Dr. Buchan's recent monograph on the rainfall at the Cape in an appendix.

The mean values for the ocean are derived from Dr. Black's revised figures in the *Journal of the Manchester Geographical Society*, plus the data obtained by the *Novara*, *Gazelle*, and *Elisabeth*, from which the mean rainfall per rainy day in the different zones of each ocean is calculated, and the probable annual precipitation is obtained by multiplying this by the mean number of rainy days per year, *using only German observations*. This is the first map of rainfall over the oceans.

The most striking feature in the new annual rainfall map for the ocean is the great area of excessive rain (over 2000 mm., or 80 inches per annum) over the Atlantic between Newfoundland and Ireland, and the westward extension of the Sahara conditions (rainfall under 250 mm., or 10 inches) to 65° W. This parched area practically does not occur in the South Indian ocean, and in the South Atlantic only as a very narrow tongue running north-west from the Kalahari desert, in the region where the south-east trade wind blows most regularly. In the Indian ocean the region between 15° and 20° S. has more than 2000 mm. (80 inches) of rain, which Dr. Supan explains by a wider extension of the north-west monsoon here. This can hardly be the case, as the wind map of the *Deutsche Seewarte Atlas* of the Indian ocean says of this region, "Stetiger Passat, Januar mässig, Juli frisch," which explains the heavy precipitation in the east of Madagascar, but not the continuation of it nearly as far east as 120° E.

Comparing the continental and ocean rainfall, it is seen that the latter is greater than the former in high latitudes, but lower in the trade wind regions outside the equatorial rain belt, for only here the summer breaks the rule of the normal trade winds.†

Dr. Supan has also prepared the first seasonal precipitation maps of the world. They are a welcome addition to our knowledge. The winter characteristics are drought, with rain round a fringe of coast where westerly storm winds blow or steady trade winds are deflected upwards. The Mediterranean is rainy at this season, but Dr. Supan is probably wrong in showing a precipitation of over 60 mm. over the Iranian plateau, for two years' records at Ispahan give a mean of only 5 mm., at Meshed (three to six years) 41 mm., and at Kabul (three years) 40 mm.

In summer the rain is maximum at most inland places, and the dry areas are either in very high latitudes where the temperature is low, or in the trade-wind regions. The effect of the movement of the trade-wind belts on the positions of the upwelling cold areas of the oceans and on the rainfall of the west sides of the continents is noticeable. In low latitudes in the Atlantic we find dry summers between 40°–27° N. and 35°–30° S., persistent drought between 27°–19° N. and 30°–17° S., dry winters between 19°–7° N. and 17° S.–1° N., and persistent rains between 7°-1° N. In Western Australia there is no coastal region of persistent drought, in western North America the winter drought area does not occur, and is very slightly developed in South America, whereas the persistent drought area of the latter stretches from 30°–4° S., corresponding to the great extension of cold coastal waters.

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* "Die Verteilung des Niederschlags auf der festen Erdoberflache," von Alexander Supan. *Petermann's Mitteilungen*, Engäzungsheft, Nr. 124 (Gotha: Perthes, 1898), pp. iv., 103. Three plates of maps. Price 7M. 40Pf. "Die jahrlichen Niederschlagsmengen auf den Meeren." *Petermann's Mitteilungen*, Nr. 44, pp. 179–182. One plate. Gotha: Perthes, 1898.

† The writer will deal with the mean annual rainfall over the land in discussing his own map, shown and described at a meeting of the Scottish Meteorological Society, before Dr. Supan's map was published. (This will shortly be published by the Royal Geographical Society.)

Autumn is rainier than spring, as the effect of the summer heat is still felt in autumn, while the cold of winter still affects the spring. Owing to the changes from month to month being much greater in spring and autumn than in winter and summer, a map of spring and autumn rainfall is not so accurate a picture of the conditions in any one of the three months making it up as one of the other two seasons.

Dr. Supan's general conclusion as to the seasonal distribution of rain may be summarized as follows:—

1. If we consider the mean precipitation of the zone between any two parallels, the maximum occurs in summer, and autumn is rainier than spring.

2. With the exception of the sub-tropical dry areas, the rainfall is not only greatest, but also most evenly distributed, at the time of the sun's highest noon position.

3. Winter and summer rains have different origins, and the evaporation of continental waters is an important factor in the latter, and condensation conditions are also more favourable. Hence—

4. The diminution of the rainfall means from the coast to the interior is much greater in the case of the year than in the normal conditions of summer.

An analysis follows of the value of the factors in different parts of the world at different seasons in the equation—

$$R = (L + M)K$$

where R is the rainfall, and L and M denote water-vapour of land and marine origin respectively, and K is a constant. It is well, however, to insist on the fact that practically all water-vapour is ultimately of marine origin, which is rather lost sight of in this analysis.

A useful little inset map shows the distribution of regions where rain falls at all seasons of the year, and also where it hardly ever falls.

The most original part of the paper is the map of rainy seasons and mean annual range of rainfall determining different degrees of periodicity. Winter and summer rains are distinguished according as most rain falls in one or the other half of the year. The range is obtained by subtracting the minimum monthly rainfall from the maximum, and calculating the percentage this difference forms of the mean annual precipitation. In a number of cases the maximum monthly rainfall does not occur in the rainy half of the year, as, for instance, at Colombo or Besançon or London, or in a number of stations in Central England. In using the map, it is necessary to distinguish clearly between the two things shown on it, and not to interpret the colour shades as indicating the proportional excess of the precipitation in one half of the year. It would have been better had Dr. Supan used two maps, or adopted a different scheme of representation on the one. Apart from these criticisms, the map is a most useful and interesting one. In middle and high latitudes winter rains occur on islands and round the coasts only, reaching nearer the equator, as well as further inland, on the west than on the east, and also extending over the oceans. Winter rains also fall on the east side of the intertropical lands, subjected to the trade winds. A third type of winter rain is found in the higher elevations of regions where summer rains are most plentiful on the low grounds; for instance, in the highlands and uplands of Central Europe. There is thus a height at which winter and summer rainfall is equal. This Dr. Supan terms the inversion level (*Umkehrungsniveau*), and he shows that this is lower the smaller the range of rainfall. The greatest of these islands of winter rain lies south of the Ohio, between 97° W. and the Atlantic, excluding Florida and the coasts of Georgia and South Carolina. The height of this inversion level increases with the distance from the sea. A double inversion level may occur if the land rises high enough and is not too far from the sea, as in the Western Ardennes.

Dr. Supan draws a line, the hydrometeoric equator, dividing regions experiencing the rainfall conditions of the northern winter half-year from regions which have those of the southern summer half-year, and *vice versâ*. This bends south of the astronomical equator in the east, and north in the west, of the continents, which may be interpreted, in the present writer's opinion, as a monsoonal phenomenon.

The percentage ranges of rainfall are divided into four groups: under 10, 10 to 20, 20 to 30, and over 30 percentage of the annual total. (1) When the mean range is under 10 per cent., rain may fall at all periods of the year, but such regions are characterized by irregularities in the rainy periods from year to year. A large portion of Europe lies in this region, and the whole area may be defined as that of cyclonic storms. (2) The region of moderate periodicity, 10–20 per cent. range, possesses months in which only maximum or only minimum values are registered in a series of years, and never both. The rain-curve of the year is flatter than in (3), the region of strong periodicity, over 20 per cent., where from year to year rainy and dry seasons are sharply and consistently divided from each other. This is characteristic of tropical and sub-tropical lands.

Means for Labrador longer than Dr. Supan's confirm his supposition that this region is one of prevalent summer rains; but the present short-period figures for Ispahan, Kabul, and Meshed point to a greater periodicity in these regions than Dr. Supan has shown.

The amount of annual rainfall varies inversely as the range, other conditions being the same, except in monsoon lands and in sub-tropical lands with a summer minimum, in both which cases the range depends on the maximum.

It is surprising to find a geographer like Dr. Supan, with all the resources of a great cartographical establishment at his disposal, using a Mercator projection for his rainfall maps. The colour scheme, too, could be improved. A dull brown comes disconcertingly between greens and blues. If it was necessary to use this at all, it should surely have been employed for the lowest rainfall. In other respects the work is excellently reproduced.

Finally, it would have added still further to the value of the map had a distinction been made between regions with rainfalls over 2000 mm., and had the 1500-mm. line been drawn.

Dr. Supan's work makes a great addition to our knowledge of the distribution of rainfall, furnishes a collection of valuable data expressed in the same unit for all extra-European lands, and is full of suggestions and explanations, which, while not always final, help us to state the conditions of the problems to be solved more satisfactorily, and are stages on the way to correct solutions. Dr. Supan has produced a classical monograph on rainfall.

THE MONTHLY RECORD.

EUROPE.

A National Park for Germany.—We learn from *Globus* (vol. 74, No. 20) that a scheme which has been set on foot for the formation of a national park for Germany after the model of those in the United States is likely to meet with success, having already been brought under discussion by the Prussian Ministry of Agriculture. The chief merit for the agitation of the idea is said to rest with Herr Wetekamp, who early in 1898 pointed out the necessity of measures for the preservation of the indigenous flora and fauna, in view of the constant encroachment of cultivated plants and domestic animals. This could only be done by the setting apart of districts which have so far retained their natural characteristics, and protecting them from modifying influences. In order that the various natural types of surface might be preserved, it would be necessary to reserve not merely forest regions, but areas of bog, heath, etc.; and Herr Wetekamp is of opinion that, although in Germany they must be content to work on a more modest scale than in America, the results aimed at might be attained by the reservation of areas of a few square kilometres in various parts of the empire.

ASIA.

Captain Deasy in Central Asia.—Captain Deasy writes from Yarkand, under date October 22, 1898, briefly announcing the results of his recent summer journey, fuller details of which he promises by the next mail. He had made an attempt to find a direct route into Northern Tibet across the Kwen Lun, west of the part explored by Roborovsky, but had been foiled by the complete absence of vegetation and the existence of a very high range of snowy mountains, the south side of which he had surveyed in 1896. He had also been hampered by bad weather and illness, as well as by the obstructions put in his way by the Amban of Keria, who refused to allow him to travel *viâ* Polu to the Aksai Chin. He speaks, however, of having discovered the sources of the Khotan Daria in lat. 35° 35′ and approximately long. 81° 40′ E. This would place them considerably to the south-east of the position usually assigned to them, and would bring them very near the upper basin of the Keria-daria, as shown in our maps ever since the survey of the Pundit attached to the Forsyth mission, so that further details respecting this part of the journey will prove of interest. Captain Deasy expected to make a trip to the Pamirs, and to return in the spring to the Aksai Chin and Khotan-daria.

Mr. Cobbold's Journey in Central Asia.—A somewhat extensive journey has lately been made by Mr. R. P. Cobbold, late 60th Rifles, through Turkestan and the Pamirs, but, owing to the large number of travellers who have visited those regions within recent years, comparatively few additions to our geographical knowledge can be expected to result from it. Mr. Cobbold set out on his journey in company with Captain Deasy (in September, 1897), but on reaching the Pamirs the travellers separated, Mr. Cobbold making his way to Kashgar by the Gez defile. From Kashgar he crossed the Tian Shan range by the Turgat (Tur Agat) and Tash Rabat passes and Lake Chatir Kul, to the Naryn valley, and finally to Lake Issyk Kul. In this section of his route, he was, we believe, on ground not previously visited by an Englishman, though known from the explorations of Russian and other travellers. At Akbashi he experienced a temperature of 27° Fahr. below zero. The Tian Shan country reminded him much of Kashmir, the hills being covered with pine forests. After visiting Viernoe, and attempting to penetrate the Ala-tau range, he made his way to Lake Balkash, following the course of the Ili. The temperature at the lake fell to 36° Fahr. below zero. Returning to Viernoe and recrossing the Tian Shan, of the mineral wealth of which he speaks enthusiastically, he again reached the Pamirs by the Gez defile, the Alai being reported as blocked by snow. He had hoped to cross the Pamirs from east to west, but on arriving at Kala-i-Wamar, on the Oxus, by way of Kara-kul, Tashkurgan, and the Bartang defile, he was arrested as a spy and taken to Shignan, where there is a Russian fort about 2 miles from the Afghan post at Kala Bar Panj. Thence he was sent back to Chinese territory, which he reached by the Kara-art pass (July 1). Passing round the base of Mustagh-ata, he reached Tashkurgan, in Sarikol, and recrossed the Hindu Kush into Gilgit, arriving there on August 4. Besides making botanical collections, Mr. Cobbold took a considerable number of photographs, and also brought back some volumes of ancient manuscripts. He does not appear to have made any survey, but thinks he will be able to correct some inaccuracies in the maps of the country between the Kara-kul and the Oxus.

Prof. J. Walther on the Oxus Problem.—Although the once accepted idea that the Oxus formerly flowed to the Caspian has of late years lost ground, many writers have thought that in times of exceptional flood some water may have found its way into the Uzboi (and thence into the Caspian) by way of the Sarikamish depression. The latest writer on the subject, Prof. J. Walther (*Petermanns Mitteilungen*, 1898, No. 9), who has studied the whole question with much care on the spot, entirely disbelieves in any such former connection, and his discussion of the subject, based chiefly on physical-geographical and geological grounds, is perhaps the most scientific that has yet appeared. At the outset, he explains Anthony Jenkinson's statement as to the former flow of the Oxus, by showing that he evidently confused Lake Aral with the Caspian; his statement that the water was fresh is in itself sufficient proof, and his account of a change in the course of the river must have referred to a branch of the delta only, the natural tendency of the stream to shift to the east having been perhaps reinforced by human agency. Prof. Walther considers that ancient literature, when properly understood, supplies no proof that the Oxus ever flowed to the Caspian, for Abulghazi has been shown by Kiepert to be untrustworthy. Coming to the geological side of the question, he shows that the mud characteristic of the Oxus deposits is of a dark grey colour, while a careful examination of the bed of the river at Charjui by means of borings has proved that for centuries the stream must have carried the same mud as at the present day. Yet such mud is entirely wanting in the neighbourhood of Usun-Ada, where alone on topographical grounds the supposed mouth could have been. The levelling which has been carried out along the Uzboi shows that there is no regular slope of the ground, but that there are hollows separated by sections at higher altitudes. Again, the channels are not continuous, but suddenly cease and give place to stretches of unbroken desert. Prof. Walther therefore attributes them solely to the action of the desert climate, showing how wadis may be started by a sudden torrential downpour, and afterwards excavated further by the action of winds, etc. Konshin's idea that the channels might have been excavated by the retiring Aralo-Caspian sea of former times is, he shows, untenable, because the retrogression of the waters would be gradual, being due simply to the excess of evaporation over water-supply.

Count Zichy's Journey in Mongolia.—Count Zichy writes to *Globus* (vol. 74, No. 20), under date September 10, 1898, giving some account of the manners and customs of the people of Urga, in Mongolia, which place we had reached by way of the Buriat country and Kiachta. It will be remembered that the primary object of the journey is the elucidation of the early history of the Magyars, but the letter contains no information on this subject. Among the Buriats Count Zichy had principally devoted himself to the study of the Shamans. At Urga he had mixed with the Mongols and learnt much of their habits. He remarks on their religious fanaticism, and sends photographs (taken by the lamas, as strangers may not enter the presence) of the Bogdo Gegen, or supposed incantation of the Deity, to whom the place owes its sacred character. A large number of meteorological observations had been taken during the journey, whilst many photographs of inscriptions, tombstones, etc., had been secured, and good collections had been made by the zoologist of the party. At Urga the travellers found the daily variations of temperature very trying; between 5 a.m. and midday, the thermometer would rise from 30° to 107° Fahr. Count Zichy was about to cross the desert to Kalgan, and hoped to reach Peking early in October. His letter took little over a month to reach Germany from Urga.

A Trip through Hunan.—Mr. M. O'Sullivan has recently written an interesting report on a trip to the province of Hunan, in mid-China, which he made last winter and spring, at the instance of the Shanghai Chamber of Commerce. He started from Hankau in a large houseboat on December 14 last. About 460 *li* above is the junction of the Nan-ho with the Yang-tse, the former being called the Ta-ho, or "great" river, and the latter the Shao-ho, or "small" river, a matter of surprise to the traveller, though later on he came to the conclusion that the more important designation was warranted by the depth and volume of the Nan-ho. The point, however, is one of some interest and geographical importance, and can hardly be said to be as yet definitely ascertained. The traffic on the Hunan waters, like that on most of the Chinese rivers, is enormous, and crafts of all sorts and rafts are seldom out of sight. Mr. O'Sullivan's river survey work began at Yo-chau, his first halting-place, and the gate of Hunan, where the river narrows down to about 400 yards across. From thence a running survey was made of the channels across the Tung-ting lake for a distance of 200 *li* (2·78 *li* make a mile) as far as Lenlingtan. Twenty-eight *li* beyond Lenlingtan is the town of Lintzakon, which, though small, is an important place, as all the trade carried on between Central Hunan, Western Hunan, and Kwei-chau passes through a canal which branches off to the west at this place. Changsha, the provincial capital, is a very important city and distributing centre. Two islands occupy mid-stream, while to the west rise hills well wooded and suggestive of a cool retreat, when the blazing sun of the 28 N. latitude makes the busy city beneath too hot for comfort. Situated some 90 *li* above the provincial capital is Siangtan, once the first commercial centre in the province, and even now boasting a population well over 500,000. It was formerly the centre of the banking and mercantile exchange, but of late years the tendency has been to concentrate this class of business in Hankau. The tea business has also declined here as elsewhere. Heng-chau-fu, 560 *li* above Changsha, is another distributing mart, and from hence the interior is reached by small native cargo boats, which ply on the waterways which intersect these parts for over 200 miles. This forms the terminus of the Siang, as far as navigation by small steamers is concerned, but there are three dangerous barriers of rocks, which should be removed before steamers attempt to reach so high a point when the waters are low, and a few shallow crossings which should be dredged. When this is done, 300 miles will have been added to the navigation of the Yang-tse between Hankau and Ichang. Changte-fu, the capital of Western Hunan, vies with Changsha in size and importance, and runs a close second as to trade. The population of 200,000 is mixed, including a colony of over 4000 Mohammedan families, who live in the eastern part of the city, and are devoted and even warlike followers of the Prophet. They own three mosques. Mr. O'Sullivan was not a little surprised at the number and variety of European goods for sale in the markets of Changte-fu; he gives a useful list of these, as well as of those of Japanese manufacture. The market for all these goods at Changsha, the provincial capital, is not so good as that at Changte-fu, and the Chinese appear to be more accustomed and well disposed to foreigners at the latter place. The vast majority of the population earn a livelihood on or by the water, the women performing much of the agricultural work. When the rice is gathered in, one year's supply is put aside, and the remainder, if any, is sold, a large quantity going to Hupeh, which is said to be dependent on Hunan for rice. The hills, however unproductive when viewed from the standpoint of the husbandman, yield large quantities of coal, iron, antimony, copper, lead, and zinc. The area of the coalfields of Hunan is said to be more than that of all Europe, the best quality being obtained from Ping-shan-hsien, on the borders of Kiang-si, whither a qualified Chinese mining engineer has been despatched by H.E. Sheng, from Shanghai. Hunan, Mr. O'Sullivan remarks, has been the hot-bed of conservatism and anti-foreign feeling, and it was only at the point of the bayonet, so to speak, that telegraph-poles were allowed to be erected. At the present day three places, and no more, viz. Yo-chau, Changsha and Siangtan, are connected with the network of wires, efforts to extend them elsewhere having been forcibly resisted by the people. As a set-off against this, it should be stated that the present governor has installed electric lights at the Yamen, and at the beginning of 1898 over a hundred shops in the vicinity of the Yamen were lighted by electricity. Two steam despatch boats have been procured by him, and he has also established the Shi Wu College for the study of the English language. Many of the young *literati* are learning English and making good progress, and a Medical School is to be established at Changsha, a further earnest of the development of this important part of the Yang-tse basin. Mr. O'Sullivan has since paid a second visit to Hunan, on a mission connected with the establishment of a Mines Department for the province. His reception on that occasion, in May last, at the hands of the authorities and the people, was very friendly, and a strong desire was expressed by some of the more enlightened officials that means should be taken by the British Government to organize an official mission to the Changsha, and open up communication with the principal towns. The same recommendation is made by Mr. F. S. A. Bourne in his Foreign Office Report issued last spring.

The Mountain Dwellers of Formosa.—In the tenth number of *Petermanns Mitteilungen* for 1898, some account is given of Formosa and its mountain-dwellers, by R. Schumacher, who bases his remarks on his own observations during a visit to those people. He gives special attention to the origin of the Formosan mountaineers, about whom very little has been known until quite recent years. The opinion has often been expressed that they belong to various races, but this is doubted by Herr Schumacher, who brings forward arguments for supposing them Chinese by race. He concludes, from the well-thought-out principles displayed in the form of their settlements (examples of which are to be found both in India and China), that they are not the primitive population of the island; and although the fact (of which he was assured both by Chinese and Japanese) that they are Brahmans, might point in the direction of India as their original home, he recalls the fact that before the introduction of Buddhism the Chinese were in part Brahmans. The differences now to be observed between the mountaineers and the Chinese he attributes to the long isolation of the former, but of positive evidence for a former connection he gives but little, his principal points being the similarity of many of the instruments seen in the Formosan mountains, with those once in use among the Chinese, while he draws a comparison between the isolated family life of the latter and the state of feud prevalent among the mountaineers. In his general notes on the island, Herr Schumacher discusses the question of the unhealthiness of the island, holding that it arises in part from preventible causes, particularly the bad situations chosen for the settlements. The introduction of rice cultivation has, he thinks, exercised a deleterious influence. With regard to the orography, he calls attention to the fact that there are in the east of the island two parallel chains with a wide fertile plain between them, whilst a curious point noted is the almost universal black colour of the domestic animals.

AFRICA.

Scientific Expedition to Central Africa.—A committee has been formed, consisting of Sir John Kirk, Dr. P. L. Sclater, Mr. Thiselton-Dyer, Prof. Lankester, and Mr. G. A. Boulenger, for the purpose of organizing a new expedition for the examination of the fauna of the African lakes. The interesting results of Mr. Moore's expedition to Tanganyika, already noticed in the *Journal* (vol. xii. p. 313), justify the anticipation that still more valuable additions to our knowledge of the geological history of the continent would ensue from the more complete investigation of the lake fauna, especially in the part of the great central depression north of Tanganyika. Mr. Moore has already shown that the remarkable fauna of marine affinities discovered in that lake does not exist in Nyasa or in any of the lakes which have so far been examined from this point of view. It may, however, be found in Lake Kivu, and in the Albert Edward and Albert lakes, and this is the more probable, as some resemblance has been noticed between the organisms of Tanganyika and those of the Nile. The proposed expedition will again be placed under Mr. Moore's leadership, and the idea is for him to proceed first to Lake Tanganyika, making his way northwards thence to Lakes Kivu and Albert Edward, and afterwards striking eastwards and returning to the coast through Uganda and British East Africa. A sum of not less than £5000 (a part of which, including a contribution by the Society, has been already promised) will be required for this purpose, and the committee appeal for help to those interested in the objects of the expedition. Although much has been done both by the Belgians and Germans to explore the country north of Tanganyika, there is no doubt that useful geographical results would also be gained from the undertaking.

Dr. Cureau's Surveys on the Nile-Congo Watershed.—Some extracts from a recently published report of Dr. Cureau, who about a year ago was commissioned to survey astronomically the route followed by M. Liotard and his officers between the Mbomu and Dem Ziber, in the old Egyptian Bahr-el-Ghazal province, are published in the *Politique Coloniale* for December 6 and 7 last. They contain some instructive remarks on the general nature of the country in those parts. Dr. Cureau describes minutely the methods employed by him in his surveys, which seem to have been executed with much care. Special attention was paid to the fixing of the position of Dem Ziber, the latitude of which was obtained by four series of circum-meridian observations, two north and two south; the longitude by the observation of four occultations and twelve equal altitudes of the moon and of a star. Barometrical observations were taken daily for the determination of altitudes, and though an aneroid only was employed, the results were verified by comparison with a Fortin barometer on the return to Zemio. Dr. Cureau extended his surveys to Jebel Mangayat, an irregular group of heights in the neighbourhood of Dem Ziber. The whole route from Zemio to the Mangayat crossed seven fluvial basins, four belonging to the system of the Mbomu, and three to that of the Bahr-el-Arab. The line of separation between the two versants was quite indistinguishable to the eye, and its position could only be ascertained by the accounts of the natives respecting the courses of the streams. The barometrical observations disclosed the existence of a slightly raised sill with an elevation of 600 feet above the Mbomu, or 2500 feet above the sea. It is a striking fact that this altitude hardly exceeds that of the plateaux of Mayombe, only three days from the coast. Dr. Cureau draws a sharp contrast between the country on the Nile side of the water-parting and that towards the Mbomu. Granitic formations are much more extensive in the former than in the latter, and the effect of this is seen in the colour of the soil, which is much lighter in the Nile than in the Congo basin. The crystalline group of Mangayat is likened to a handful of big stones flung into a marsh. It consists of a number of isolated masses, the largest a little over half a mile in length, and 700 feet above the plain. The layer of humus is much thicker towards the Mbomu than in the Nile basin; it helps to retain the water which falls during the rainy season, especially at the lower levels. Towards the north, on the contrary, all the streams are periodical, and the country is an immense marsh or an arid plain according to the season. Attempts at cultivation in these parts have met with slight success, and both in its flora and fauna the northern slope of the country approaches in character that of the desert regions to the north. After the annual grass-burnings the surface presents a mournful and monotonous appearance, parched by the fierce rays of the sun.

The Belgians on the Upper Nile.—Since the occupation of Rejaf on the upper Nile by the Belgians under Captain Chaltin (*Journal*, vol. x. p. 213), a good deal of fighting seems to have taken place between the garrison and the dervishes of those parts. In June last a determined attempt to surprise the place was made by the latter, who were only repulsed after severe fighting, in which MM. Desneux and Bartholi were killed, and the commandant, M. Hanolet (known for his explorations on the northern limit of the Congo basin), and several of his officers, wounded. Rumours have since reached Europe that the dervish position at Bor, on the Nile north of Lado, has been taken by the Belgian troops. Although this place is outside the limits of the territory leased by the Congo State, it is pointed out by the *Mouvement Géographique* (1891, No. 48) that the position had long been a menace to Rejaf, and that it would be perfectly allowable for the State troops to clear out a dangerous enemy from their neighbourhood. Should the report prove true, an obstacle will have been removed from the path of Major Martyr who, with the Uganda troops, is advancing down the Nile from Unyoro. The Belgians are stated to have a garrison of 1000 men at Rejaf and 300 at Lado. In connection with the history of the Belgian advance on the Nile, reference may be made to a paper by Lieut. Dubreucq, in the *Bulletin* of the Antwerp Geographical Society (1898, part 2) which describes the operations of Captain Chaltin in 1896–97 on the upper Welle. Besides giving details of the fighting by which the Zande power in that region was broken, it contains some useful information respecting the organization of the Welle district under the Belgian rule.

Visit of Captain Johannes to Lake Manyara.—The second number of the *Mitteilungen aus den Deutschen Schutzgebieten* for 1898 contains a short note by Captain Johannes on the geography of the neighbourhood of Lake Manyara, in German East Africa. Lieut. Glauning had reported in 1896 that the lake had, at the time of his visit, completely dried up, with the exception of a narrow strip of swamp at its south-west side. Captain Johannes believes that in this report a confusion had been made between the small Laua ya Sereri, east of Umbugwe, and Laua ya Mueri, or Manyara. The latter he found, both in February, 1896, and July, 1897, to be an extensive lake, as shown on Baumann's map, and he was told by the Wambugwe that even in the driest seasons it maintains its usual area. The cauldron-like depression of Ngorongoro, north-west of

Manyara, proved, when visited in 1897, to have an oval shape without the north-easterly extension shown by Baumann. An accompanying sketch-map also shows a small crater-lake, north-east of Manyara, discovered by Captain Johannes in 1895.

Completion of M. Wauters' Map of the Congo State.—With the publication of Sheet X., in the *Mouvement Geographique* for November 27 last, M. Wauters' useful map of the Congo State on the scale of 1 : 2,000,000 is now complete. The present issue includes the region of the southern Congo watershed between 21° and 32° E., and, like all the previous sheets of the map, gives the results of a careful collation of all available material. The astronomical observations which supply the basis of the map are chiefly those of Capello and Ivens, Le Marinel and Francqui; but Cameron's position for Lake Dilolo has been accepted, as it fits in with the geography of the surrounding region better than that of the German travellers, which place it further east. By a curious slip, the "Pombeiros" are quoted as the authority for the astronomically fixed position of Kalala Kazembe. The chief novelty in the map is the delineation of the basin of the Lubudi, the western branch of the Kamolondo or Western Lualaba, which, however, is largely hypothetical. In accordance with his dictum that the true upper Congo (the *branche mère* of the river) is that which flows at the bottom of the central depression,[*] M. Wauters gives this title to the Lubudi, which he shows as flowing in a great valley enclosed between chains of mountains running from south-west to north-east. He continues this valley to the vicinity of Mount Kaomba, at the source of the Zambezi, and is therefore obliged to suppose two branches of the Lubudi, to the more easterly of which (crossed by Capello and Ivens in 12½° S.) he gives the name Lububuri used by the Pombeiros. There seems no good ground, however, for considering the Pombeiros' name more than a variant of the other, the intermediate form Luburi being also used. M. Wauters also shows a narrow gorge at the passage of the Lububuri through the chain of the Mitumba mountains, basing this feature on the analogy of the gorges of the Nzilo and Lufira; but it may be remarked that such a gorge is not mentioned by Arnot, who crossed the river almost in the latitude in question. Higher up M. Wauters supposes the river to drain a wide circular basin surrounded by higher ground.

River Names in the Congo Basin.—With regard to the spelling of river names in the southern parts of the Congo basin, Lieut. Cerckel writes to the *Mouvement Géographique* (1898, No. 42), pointing out that the syllable *Lu*, which appears in so many of the names as usually written, is not part of the name proper, but is merely a general designation for river, being a shortened form of Lui. Lu Mami (river Mami) is thus the correct form in place of Lomami. The syllable can be placed either before or after the name, thus Sanku Lu (not Sankuru) means "river Sanku," while the full form is also used, as in Chibu Lui. The variations are probably introduced for the sake of euphony, and different forms are used by different tribes; the Baluba, *e.g.*, use the form Lu Bu. For quite small streams, Lu is replaced by Ka, which has generally a diminutive force.

Captain Ramsay's Journey from Tanganyika to the Coast by Lake Rukwa.—Captain Ramsay, the active explorer of the less-known parts of German East Africa, read a paper on his latest journeys before the Berlin Geographical Society in June last (*Verhandlungen*, 1898, No. 7). His expedition to Ruanda, which formed the subject of the first part of the paper, has already been described in the *Journal* (vol. xi. p. 299), so that it will be sufficient now to refer to the second part, which relates to his journey to the coast, in November and December, 1897, through the more southern parts of German East Africa. Crossing the Malagarazi, Captain Ramsay proceeded southward through Tongwe and Kawende, keeping as near the shores of Tanganyika as possible, in order to survey them. This land route had not for many years been followed by a European. The bordering range, which is very high and falls steeply to the lake, made an imposing appearance, and in order to pass some of the rocky headlands, it was necessary to make wide circuits inland. The country presented a great contrast to the more northern districts, from its scanty population and small area of cultivation; the separate villages are at constant feud with each other. In Fipa and Urungu both the White Fathers and the African Lakes Company exercise much influence, and Captain Ramsay especially praises the good work of the former. Many of the porters employed on the caravan route between Nyasa and Tanganyika are recruited from the German sphere, and as they are paid in cloth, the inhabitants were found to be much more clothed than in the more northern districts. The lake was left at Kirando, and after a steep ascent of many hundred feet, the wide Fipa plateau, bare of trees, but well watered and fertile, was crossed. The whole of Fipa is subject to King Kapere, or Kapufi, belonging to the ruling race, of Mtussi type, which in Captain Ramsay's opinion must have immigrated from the north many years ago. The country is less peopled than formerly, owing to the slave-raids of the coast people, who even now have large settlements in Fipa. A steep descent of almost 5000 feet led to the Rukwa plain, where the traveller finds himself in an entirely different world. Above, the thermometer fell to 43° Fahr., while below, a heat of 111° was experienced, recalling the Red Sea in July and August. Giant baobabs, tamarinds, and woods of acacias also made their appearance. The former bed of the lake was at the time a wide sandy plain, devoid of vegetation, but it becomes swampy in the rains. Frequent dust-storms, with darkness as of night, were experienced, and to these Captain Ramsay is inclined to attribute the scarcity of game. He is at a loss to explain the sudden decrease in the area of the lake, but throws out as a suggestion a possible connection with the fall of Lake Tanganyika. The level of Rukwa is, he thinks, a trifle higher than that of the larger lake. He thinks the open water at the south end does not extend for more than 60 statute miles, with a breadth of 12 to 18 miles, and considers Mr. Wallace's estimate exaggerated, apparently through confusing English with German geographical miles. The journey was continued round the south end of the lake, and through Urori, Utena, Uhehe, etc., to Dar-es-Salaam.

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[*] M. Wauters states that the *most remote* source of the Congo would be the easternmost headstream of the Malagarazi, whereas this must be at least 400 miles less remote than the source of the Chambezi.

Lake Bangweolo.—Commenting on the map of Lake Bangweolo published in the *Journal* in illustration of Mr. Weatherley's surveys, H. Singer (*Petermann's Metteilungen*, 1898, No. 11) expresses a doubt whether the delineation of the southern half of the lake as a mere swamp should be accepted as correct. But while allowing with him that the mapping in question cannot yet be considered final, we may point out one or two inaccuracies into which the writer has fallen. Like Mr. Crawford (*Journal*, vol. xi. p. 180), he seems to imagine that Giraud showed the southern parts of the lake as open water, whereas the reverse is the case. The French traveller, like Mr. Weatherley, gives Kawende point as the place of exit of the Luapula, having found the whole region east of this, in which he searched for the mouth of the Chambezi, blocked by an impenetrable wall of reeds. In summing up the results of his survey, he says that he found but 20 miles of open water in place of the 90 shown by Livingstone. Herr Singer is in error again in saying that Giraud applied the name Bemba to the southern basin in distinction from the northern (Bangweolo). The names were so applied by Capello and Ivens, who, however, did not visit the lake, but obtained their information from the natives at some distance from it; and even they allow that the southern portion has rather the character of a swamp than of a true lake. A small extent of open water (*une petite nappe d'eau libre*) was indeed found by Giraud during his passage through the swamps, and this is the Kampolombo bay of Mr. Crawford, which is shown as a quasi-independent lakelet in M. Wauters' recent map of the southern Congo basin.

The Coal District North-West of Lake Nyasa.—The *Deutsches Kolonial-blatt* for November 1 last contains a short account of a visit by Herr Zenke to the coal-bearing district north-west of Lake Nyasa. The coal deposits were, as has been already mentioned in the *Journal*, discovered in 1896 by mining engineer Bornhardt, the results of whose surveys are shown in a map given with the *Mitteilungen aus den Deutschen Schutzgebieten* (1898, pt. 2). They occur on the eastern slope of the ridge which runs between the Songwe and Kivira rivers, and is drained by tributaries of both streams. The object of Herr Zenke's journey was to endeavour to bring a supply of coal down the Kivira to Lake Nyasa. For this purpose he obtained the services of 116 porters, who, owing to the nearness of the deposits to the surface, were able in a single day to deliver their loads at Maisura's on the Kivira, from which point they were transported in canoes. The total weight of coal amounted to 45 cwt. Herr Zenke thinks that with porters engaged under a permanent agreement the coal could be brought to the mouth of the river at a cost of 22½ rupees per ton, but he is doubtful whether the enterprise would pay at this rate. He also visited the extremely fertile and well-peopled district of Bundali, which he considers well suited for the cultivation of coffee and also of European cereals. A striking point in the geography of the region is well shown on the map of Herr Bornhardt's surveys, from which it appears that the Songwe and Kivira approach within half a mile of each other 20 miles from their mouths, being only separated by a narrow ridge of high ground.

The Origin of African Culture.—A young German ethnologist, Dr. L. Frobenius, has made a special study of the various forms of culture observable in Africa, with a view to the determination of their place of origin. He has lately brought out a book embodying the results of his researches, having previously set forth his ideas on certain aspects of the question both in *Petermanns Mitteilungen* (1897, Nos. 10 and 11; 1898, No. 9) and in the *Zeitschrift* of the Berlin Geographical Society (1898, No. 2). In the latter paper he explains his method of investigation, which he says consists of two parts bearing a relation to each other parallel to that subsisting between anatomy and physiology. Under the first head he examines the different objects—drums, bows, shields, musical instruments, etc. —associated with different forms of culture, noting the material employed and the connection between its distribution and that of the object in question. Under the second head he discusses the forms of culture as influenced by such factors as the nature of the habitat, endeavouring to trace the routes by which the different forms have made their way into Africa from neighbouring regions. The general result is to distinguish four forms of culture, the distribution of which is shown on a series of maps, viz. the Nigritic, Malayo-Nigritic, Indo-Nigritic, and Semito-Nigritic, the names being applied as indicative of their supposed origins. The author devotes special attention to the second of these, which forms the subject of the articles in *Petermanns Mitteilungen*. He seeks to show that a well-defined region in West Africa (Congo basin and shores of the Gulf of Guinea) is marked by a form of culture which in its component parts shows a decided affinity to that of Western Oceania (Melanesia, etc.). Herr Frobenius's speculations are certainly ingenious, but are hardly likely to be accepted without a more thorough investigation than has yet been given to the subject.

Captain Wellby's Expedition to Abyssinia.—We are informed by Mr. J. H. Wellby that his son, Captain Wellby, well known for his journey across Northern Tibet, has reached Addis Abeba, *en route* for the Galla countries and Lake Rudolf. In an interview with King Menelik he has obtained permission from that monarch to travel wherever he may wish, as well as the promise of a safe conduct on his way down the Omo to Lake Rudolf, and letters to all the chiefs through whose territory he may pass. On arriving at Lake Rudolf, Captain Wellby hopes to strike westwards to one of the sources of the Sobat, and descend that river to the Nile.

AMERICA.

Sir Martin Conway in the Andes.—Sir Martin Conway continues his ascents in the Andes with untiring energy. Telegraphing to the *Daily Chronicle* on December 10, he announced his successful ascent of Aconcagua on the 7th of that month, having taken only four days to make his way from Banos del Inca to the summit. Writing to the Society from Bolivia, Sir Martin states that he hoped to visit Tierra del Fuego and climb Mount Sarmiento. He has sent home very considerable collections, and also various maps, partly the result of his own surveys. He expects to reach England in February.

AUSTRALASIA AND OCEANIC ISLANDS.

South Australian Tablelands.—Two reports, by Messrs. D. Lindsay and C. Winnecke, on the tablelands of the northern territory of South Australia have recently been issued. The country known as "The Tableland," described by Mr. Lindsay, lies between latitudes 17° and 21°, and between the overland telegraph line and the Queensland border. It is about 1000 feet above sea-level, and is an undulating country with extensive plains. The more eastern portion is the highest, a low range some 100 feet to 150 feet high being the most conspicuous feature. The water-channels are the Lorne, the Rankine, the James, Buchanan, and Playford rivers, besides numerous creeks. These rivers and creeks empty into large depressions, forming extensive lagoons and lakes. The climate is healthy, while the average rainfall is about 20 inches per annum. The country appears to be well adapted for sheep, as also for cattle and horses. The country explored by Mr. Winnecke extends from lat. 18° 30′ S., long. 134° 30′ E., to lat. 22° S., long. 137° E. and 138° E., a distance in a north-west and south-east direction of nearly 400 miles. To the north-east of this line, the country examined to some distance beyond the Queensland boundary (long. 138° E.) consists of open, magnificently grassed Mitchell grass downs and plains, intersected by numerous large and small watercourses. Near the Queensland border an abundance of water can be obtained at a depth of about 200 feet below the surface. The temperature ranges from 26° Fahr. in June, to 120° in January. The elevation of this country above sea-level on the western parts is about 800 feet, and on the eastern portions, near the Queensland border, lat. 22°, about 450 feet.

POLAR REGIONS.

Supposed New Island in the Spitsbergen Sea.—Mr. Arnold Pike, who a year ago gave the Society an account of his cruise in the seas around Spitsbergen, writes under date November 18, 1898, informing us of a voyage to the same seas made during last summer by his captain, P. Nilssen, of Arendal. During the voyage Captain Nilssen had hunted round an island (which he named Victoria after the vessel) lying in 80° 8′ N., 37° 17′ E. It is roughly 9 by 5 miles in extent, and 500 feet high. The position assigned would place it some 40 miles to the northwest of the homeward track of the *Windward* in 1897, whilst it would lie about midway between White island (seen by Captain Kjeldsen in 1876 and by Captain Johannesen in 1887) and Franz Josef Land. Mr. Pike throws out the suggestion that the new island may be the long-sought Gilies Land, but it is to be remarked that the altitude of White island (over 2000 feet) agrees much better with the "very high lands" said to have been seen by Gilies, though its distance from North-East Land does not amount to anything like the 25 Dutch miles supposed to separate Gilies land from the latter (Daines Barrington, 'Possibility of approaching the North Pole asserted,' p. 144). The latitude agrees well with that mentioned in the old account. Captain Nilssen saw no floe-ice before reaching White island, but on approaching Franz Josef Land was prevented by ice from landing. He had been in the direction of Greenland earlier in the year, but could not get within 26 miles of Liverpool coast for the same reason.

The Andrée Search Expedition.—News has been received from the Andrée search expedition under Herr Stadling, giving details of its proceedings down to November 29. On September 16 the leader wrote from Balkur, in the Lena delta, saying that the steamer *Lena* had arrived from Yakutsk, seventeen days late, and that Dr. Nilson was about to return to that town by river, while he himself and Herr Froenkel would proceed down the Lena to the sea, and so to the Olenek. Dr. Nilson had obtained rich botanical collections. Herr Stadling makes some observations on the fisheries of the Lena delta, to develop which efforts have of late been made. He thinks that if the contemplated railway from the upper Lena to join the Great Siberian railway became a *fait accompli*, a trade might spring up for the supply of fish to the industrial and mining districts of the south. The latest account, sent from Yeneseisk, reports that in the voyage to the Olenek Herr Stadling and his companion were wrecked, but managed to reach an uninhabited island, 170 miles from the river, where they remained ice-bound seventeen days until succour reached them. Gaining the mainland, they procured reindeer and proceeded to the mouth of the Anabar, and thence *viâ* Khatanga bay and the Taimyr lake region to the Yenesei. No trace of Andrée or his balloon had been discovered.

Mr. Borchgrevinck's Expedition.—A telegram to the Society from Hobart, Tasmania, on December 19, announced the departure southwards of Mr. Borchgrevinck's antarctic expedition, in the *Southern Cross*.

GENERAL.

The Seventh International Geographical Congress.—Circulars of invitation, setting forth the proposed arrangements for the Seventh International Geographical Congress, to be held during 1899 at Berlin, have been issued by the Berlin Geographical Society. The meeting will take place from September 28 to October 4, and both before and after that period excursions will be arranged through such parts of Germany as may be of interest with regard to physical and economic geography. One to Hamburg, in response to an invitation from the Geographical Society of that city, is specially mentioned. The subjects to be discussed at the Congress are divided into eight groups, under the headings (1) Mathematical Geography and kindred subjects, (2) Physical, (3) Biological, (4) Industrial and Commercial Geography, (5) Ethnology, (6) Topical Geography, (7) History of Geography and Cartography, (8) Methodology, Bibliography, etc. It has been decided that no exhibition will be arranged on the part of the Congress, but it is possible that private exhibits will be made. The payment securing membership is 20 marks (£1 or 25 francs), while ladies accompanying members will be admitted as associates at half that sum. The notification of subjects for discussion or papers offered must be made before April 1, and manuscripts must be sent in not later than June 1. Papers must be written in English, French, German, or Italian. The office of the Congress is at 90, Zimmerstrasse, Berlin, S.W., to which all communications are to be addressed.

OBITUARY.

John Barrow.

By the President.

The father of the Royal Geographical Society, the Fellow who had been at the top of our list since the death of Mr. Ainsworth, has passed away in his 91st year.

John Barrow was born in 1808. He was the second son of that famous Secretary of the Admiralty whose memory is revered by all geographers. Sir John's son was so intimately connected with the work of his father, that we cannot recall the services of the one without dwelling for a moment on the better-known efforts of the other, in the cause of discovery and exploration. Sir John Barrow* was secretary to the Admiralty from 1804 to 1845, a period of forty years, with one brief interval during the administration of "All the Talents." He had previously visited China with Lord Macartney, and had travelled in South Africa and in Iceland. Jointly with Admiral Smyth, Sir John Barrow was the founder of the Royal Geographical Society. The first organizing Committee met in his room at the Admiralty, and he was President of the Society from 1835 to 1837. It is to Sir John Barrow's untiring advocacy that the important work of discovery and exploration became an essential part of the duties of the navy in time of peace. This has been recognized by every administration during more than a century, but never more so than in the days of Barrow at the Admiralty. In the last 120 years, besides enterprises in Africa, the Government has despatched no less than thirty polar expeditions, and has assisted four others with money and stores and by lending officers. The country has cause to lament that there has been no successor to Sir John Barrow at the Admiralty, endowed with the same spirit coupled with the same zeal and energy.

In all this the Secretary of the Admiralty found a most zealous and efficient second in his son. John Barrow became a clerk in the Admiralty as a young man, and in 1833 he was elected a Fellow of the Geographical Society, in the work of which he long took an active part. For some years he was secretary to the Raleigh Geographical Club. His position gave him innumerable opportunities, which he never missed, of helping and furthering the interests of naval officers. His acquaintance among them was very extensive. They all felt a regard for him, and in many this feeling was strengthened into affection and close friendship. For it was impossible to know John Barrow without feeling an affectionate regard for him.

More especially was his attention given to that polar enterprise which was so dear to his illustrious father. He took the deepest interest in the equipment of arctic expeditions, and still more in the welfare of arctic officers and men. Fitz-James, Sherard Osborn, Richards, M'Clintock, were among his closest friends. It is impossible to peruse the letters of Captain Fitz-James to John Barrow, before the departure of the Franklin expedition, without being convinced of the great influence their staunch friend at the Admiralty had among naval officers, and of his desire to use it in furthering their interests. Unostentatious, and deeply rooted in warm friendship and in the memory of many a kindly act, that influence was extensive, and always used for good objects. Every surviving arctic officer will feel that mine is the language of truth.

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* See his obituary in the R.S.G. *Journal*, vol. xix. p. xxxiv.

John Barrow was indefatigable in collecting every scrap of intelligence relating to arctic work, besides printed and manuscript books on the subject. He also had all published polar engravings, and a most valuable gallery of portraits of arctic worthies painted by his friend Mr. Pearse. There is a portrait of John Barrow in Pearse's famous picture of the Arctic Council, which has been engraved.

Latterly John Barrow was keeper of the records at the Admiralty, where he did most valuable service. On his retirement he energetically joined the volunteer movement, and became an enthusiastic alpine climber. He was Lieut.-Colonel of the 5th Volunteer Battalion of the Rifle Brigade. He was an original member of the Hakluyt Society, and edited a volume in 1852, 'Coat's Geography of Hudson's Bay.' He was also the author of a 'Life of Sir Francis Drake' and of 'Elizabethan Naval Worthies.' The results of his alpine work appeared in his 'Expeditions on the Glaciers' and 'Mountain Ascents in Westmoreland and Cumberland.' He also published 'Travels in the North of Europe,' and 'A Voyage to Iceland.'

But it is as the warm and untiring friend of arctic officers that John Barrow will be longest remembered. They presented him with a silver testimonial representing discoveries within the arctic circle on a globe. He died at a good old age on Friday, December 9, 1898. Most of his friends have gone before him. But there are still some left who remember the quiet enthusiasm of the ripe geographer, and cherish in their hearts the memory of the never-varying kindness of their old and tried friend, John Barrow.

Sir George Baden-Powell, K.C.M.G., M.P.

It is with much regret that we record the death of Sir George Baden-Powell, which took place on November 20 last, at the comparatively early age of 51 years. Although he had for some time been in impaired health, it was not until a fortnight before his death that he had been known to be seriously ill, so that the end came as a shock to his wide circle of friends, who had looked forward to many years of public usefulness for him.

Our deceased associate was the son of Prof. Baden Powell, of Oxford, well known as a mathematician and geologist. At the completion of his school career, which was divided between St. Paul's School and Marlborough College, he spent three years in travel, visiting both India and the Australasian colonies. In 1872 he entered Balliol College, and in the same year published, on the basis of his own observations, an account of Australian life, social, political, and industrial, under the title "New Homes for the Old Country." In 1875 he obtained third class honours in the final classical school, having previously taken the same place in "Moderations," and in the following year he obtained the Chancellor's prize for an English essay, on the subject of "The Political and Social Results of the Absorption of Small Races by Large." On leaving Oxford, he returned to Australia as private secretary to Sir George Bowen, then Governor of Victoria; but, as the term of office of the latter had almost expired, his stay in the colony was not a lengthy one. His next sphere of action was the West Indies, whither he proceeded in 1880, as Commissioner to inquire into the effects of the sugar bounties. In 1882 he received a similar appointment in connection with the subject of West Indian administration, and for his services in this direction he was soon afterwards made a C.M.G. In 1885 he assisted Sir Charles Warren in the pacification and organization of Bechuanaland, then formed into a crown colony; and two years later his services (as joint commissioner) were requisitioned for the revision of the constitution of Malta, for which he was made a K.C.M.G. His best-known work, however, was perhaps that concerned with the Behring sea question, on which he was engaged during 1891 and 1892 as British Commissioner, and subsequently as adviser to the British Government during the progress of the arbitration.

Since 1885 he had sat as a member for the Kirkdale division of Liverpool, his wide and varied experience serving him in good stead in that capacity, and winning him general respect. He wrote much, in magazines and elsewhere, on subjects connected with political economy or of general interest. He was a keen sportsman and warmly devoted to golf and yachting, which last served in part as a means of gratifying his decided love of travel. It was during his cruise to the north for the observation of the eclipse of 1896 that he was enabled to give an early welcome from the unknown polar regions to Dr. Nansen, who subsequently became his guest during his visit to this country. Sir George became a member of our Society in 1894.

Frederick Jeppe.

It is with regret that we place on record the death of Mr. Frederick Jeppe, which took place as long ago as August last. The deceased was a native of Germany, and settled in the South African Republic in 1862. He held several government appointments, and at the time of his death was chief draughtsman in the State Survey Department at Pretoria. He has deserved well of his adopted native country by making known its geographical features, mainly by the publication of maps. The first of his maps of the Transvaal appeared in a supplement to *Petermanns Mitteilungen* in 1868.* It is based mainly upon surveys made by M. Forssman, C. Mauch, F. Hammer, and others, and is accompanied by an illustrative text. Nine years later he published a second map, which exhibits vast progress in our knowledge of the country,† in explanation of which he wrote "Notes on the Physical and Geological Features of the Transvaal," which were published in our *Journal* (1877, pp. 217–250). A third map of the Transvaal was published by him in 1889, on an enlarged scale.‡ In addition to these general maps, we owe him several excellent maps of interesting portions of the state, the last, a 'Map of the Southern Goldfields of the Transvaal' (1 : 240,000), having been published at Pretoria in 1896. An article by him on "The Kaap Goldfields," appeared in the *Proceedings* (1888, pp. 438–446), and another on the "Zoutpansberg Goldfields," in the *Geographical Journal*, vol. i. 1893, pp. 213–237.

Besides maps, Mr. Jeppe published a 'Transvaal Year-book and Almanac,' for the first time in 1877, which abounds in useful geographical and statistical information. Mr. Jeppe was an honorary corresponding member of our Society.

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* 'Original Map of the Transvaal, or South African Republic,' scale 1 : 1,850,000.

† 'Map of the South African Republic, and the Surrounding Territories,' 1 : 1,850,000. Pretoria, 1877.

‡ 'Map of the Transvaal, or South African Republic,' 1 : 1,000,000. London : Dulau.

CORRESPONDENCE.

A New Mountain Aneroid Barometer.

Mr. Murray published in 1891 a pamphlet ('How to Use the Aneroid Barometer,' 8vo, pp. 61: John Murray, Albemarle Street, London), which gave some of the results that had been obtained from numerous comparisons of the aneroid against the mercurial barometer, made by me between the years 1879 and 1890. The earlier of these comparisons were made out-of-doors up to a height exceeding 20,000 feet; and the later ones were made in the workshop down to a pressure of 14 inches, which is about what one may expect to experience at the height of 20,770 feet above the sea.

These comparisons, or experiments, brought out certain facts. It was found that all aneroids which were tested, upon being submitted to diminution in atmospheric pressure, lost upon the mercurial barometer. It was found, if an aneroid was placed under the receiver of an air-pump (having a mercurial barometer attached, in such a way that one could cause simultaneous reduction in pressure for both barometers), that, although the aneroid might for a moment read truly against the mercurial when pressure was reduced say to 20 inches, it would in a very short time read *lower* than it. It was found that this loss augmented constantly, and that in a single day, under a constant pressure of 20 inches, it might grow to half an inch and even more; and that the loss always continued to augment for several weeks, sometimes so long as seven or eight weeks. The lower the pressure, and the greater the length of time the diminution in pressure was experienced, the greater was the loss in any individual aneroid.

It was found also that aneroids commenced to recover this loss immediately pressure was restored, no matter whether it was restored entirely and suddenly, or gradually and partially as it is when a traveller is coming downhill; and that in course of time after return to the level of the sea (or if kept artificially at a pressure of 30 inches or thereabouts) an aneroid might recover all its previous loss, even although it might have experienced very low pressures, and been kept at such pressures for months at a time. Hence, in consequence of the *loss*, travellers or surveyors may be led to very much exaggerate their altitudes (unless they carry some standard for comparison which will enable them to determine the errors of their aneroids on the spot); and in consequence of the *recovery* they may be led to believe, on return to the level of the sea, that their aneroids have been working well and truly, although they may have, as a matter of fact, been doing quite the reverse.

The publication of these results led to improvements in the manufacture of the aneroid, and *some* instruments of the best class which have been constructed in late years show a distinct advance in accuracy; but it is clear, from references which have been made quite recently by travellers to their aneroids, that there are *others* which are still a long way from perfection. Mr. E. A. Fitz Gerald, for example, says in the *Geographical Journal*, November, 1897, "Our aneroids played us some very curious tricks. One of them, on being taken to the height of 19,000 feet, registered 12 inches"—that is to say, it indicated an altitude of about 25,000 feet, and was about 30 per cent. in error. This is several degrees worse than the behaviour of the instrument which was employed by Mr. Joseph Thompson during his journey in Morocco in 1888, though even *his* aneroid is said to have made his life a burden to him. One can well believe it did all that was imputed to it; for after Mr. Thompson's return, when it was tested under the air-pump at a pressure corresponding to a little lower than the height of Mont Blanc, upon being kept a week at that pressure, it acquired an error of $-1{\cdot}267$ inch, the value of which amount, at the altitude in question, exceeds 2000 feet.

Manufacturers have endeavoured to tackle the difficulty in one way, and inventors have approached it in another. The former have attempted to abolish the fundamental cause of error, and the latter see that aneroids can be rendered of greater service in the measurement of altitudes by shortening the length of time that they need be exposed to the influence of the atmosphere. The most recent experimental aneroid which has been constructed with this view is the invention of Colonel H. Watkin, C.B., chief inspector of position-finding in the War Department.

In introducing it, Colonel Watkin said in effect, though not in these words, "You point out that all aneroids lose upon the mercurial barometer when submitted to a diminution of pressure; that this loss is large when pressure is much diminished; and that the loss continued to augment for several weeks. It is, you say, apparent that the *extent* of the loss which will occur in any aneroid upon the mercurial barometer on being submitted to a diminution in pressure depends (1) upon the duration of time it may be submitted to diminished pressure, and (2) upon the amount of the diminution in pressure; and that it follows that the errors which will be manifested by any particular aneroid will be greatest when it is submitted to very low pressures for long periods. Accepting this as a correct statement of facts, I propose to construct an aneroid barometer that can be put in action when required, and 'put out of gear' or 'thrown out of action' when it is not wanted for use; and I propose to construct it in such a way that it shall not be exposed to the influence of variations in atmospheric pressure when it is *out* of action—in short, that no variations in atmospheric pressure, however large they may be, shall produce any effect upon it except at the time when it is put in action for the purpose of taking a reading." The following description, supplied by Colonel Watkin, explains the manner in which this is done:—

"In order to relieve the strain on the mechanism of the aneroid, and only permit of its being put into action when a reading is required, the lower portion of the vacuum-box, instead of being a fixture (as is the case with ordinary instruments), is allowed to rise. Without entering into details of construction, this is effected generally by attaching to the lower portion of the vacuum-box a screw arrangement, actuated by a fly nut on the outside of the case. Under ordinary conditions this screw is released, and the vacuum-box put out of strain. When a reading is required, the fly nut is screwed up as far as it will go, thus bringing the instrument into the normal condition in which it was graduated."

At first mention this idea did not appear promising, as it seemed that, however quickly an observation might be made, the aneroid would be losing upon the mercurial all the time that the reading was being taken; that when the aneroid should be thrown out of action, this loss would be shut up; and that when readings should be taken on succeeding occasions, the loss which would occur during them would accumulate; and that this would go on until at length the error would become almost or quite as serious as in an ordinary aneroid. I was, however, very urgently required to give the instrument a fair trial in the field; and after satisfying myself that, when thrown out of action, it was not affected by variations in atmospheric pressure (amongst other ways, by keeping it for six weeks under a receiver in which pressure was maintained constantly at 17 inches), I commenced to compare it against the mercurial barometer in Switzerland in last September, having intentionally refrained from taking a reading for six weeks further, after it was released from the air-pump, in order to obtain confirmation of the opinion that it was, when thrown out of action, actually impervious to the influence of variations in atmospheric pressure.

I commenced these comparisons at Zermatt on September 3 (the height of

Zermatt, according to the Swiss Federal Survey, is 5315 feet), and between the 3rd and the 8th took twenty-one readings—that is to say, the aneroid was put in action and was thrown out of action twenty-one times in the above-mentioned period. I was interested to observe whether the accumulation of loss would take place. It did occur, but the total amount was small. The aneroid had a plus error of 0·122 of an inch the first time it was used, and this was reduced to + 0·069 of an inch at the last reading. Thus there was, on an average, a loss of 0·00252 (or $\frac{252}{100000}$) of an inch on each occasion that a reading was taken.

On September 9 I carried the barometers to the top of the Gornergrat, but diverged from the way up to the summit of a minor peak called Gugel (S. F. Survey, 8882 feet). The error of the aneroid at Zermatt at the last reading was +0·069 of an inch, and on the top of Gugel it was +0·057, or $\frac{57}{1000}$ of an inch. The difference of level between the stations, it will be seen, was 3567 feet.

From the top of Gugel I came down for lunch to the hotel called the Riffelhaus (S. F. Survey, 8429 feet), and there the error of the aneroid was +0·041 of an inch.

From the Riffelhaus I went to the top of the Gornergrat (S. F. Survey, 10,289 feet), and at 4,20 p.m. the error of the aneroid appeared to be −0·052 of an inch. The readings were—

Merc. bar. inches.	Temp. in shade.	Correction for temp. inch.	Merc. bar. red. to 32° F. inches.	Aneroid. inches.	Error of aneroid. inch.
20·923	55·5	−0·051	20·872	20·820	−0·052

I was not satisfied with this comparison. The sun's rays had been piercingly hot during the ascent, and the mercurial barometer had been unavoidably exposed to them. When set up in the shade, its sensitive, attached thermometer speedily took up the temperature of the air. It fell to 55·5 Fahr., and would not fall lower. But the mercury in the barometer continued to fall long afterwards, because it was not cooled down to the temperature of the air. It is not improbable that the temperature of the mercury in the barometer was as high as 75° Fahr. at the time it was read. Assuming that this was the case, the following would be the correct comparison:—

Merc. bar. inches.	Temp. of mercury.	Correction for temp. inch.	Merc. bar. red. to 32° F. inches.	Aneroid. inches.	Error of aneroid. inch.
20·923	75°	−0·087	20·836	20·820	−0·016

On my return to Zermatt after a descent of 4974 feet, I was curious to observe what alteration there would be in the error of the aneroid. At the last reading prior to starting it had been +0·069 of an inch, and at the first one taken after the return it was precisely the same! More astonishing than this, the mean of eight readings taken on the four following days (September 10 to 13) came out +0·068 of an inch.

On September 13 I went again to the Gornergrat, and between 12 and 3 read the barometer three times. The following figures show the means of the three readings:—

Merc. bar. inches.	Temp. in shade.	Correction for temp. inch.	Merc. bar. red. to 32° F. inches.	Aneroid. inches.	Error of aneroid. inch.
20·780	50° F.	−0·052	20·729	20·717	−0·012

This supported the opinion that the reading on September 9 was taken too soon, and that the temperature indicated by the attached thermometer was lower than the temperature of the mercury in the barometer. The mean of two comparisons at Zermatt after this second visit to the Gornergrat gave as the error of the aneroid +0·030 of an inch.

I then went down the valley of Zermatt, and stopped successively for several days at each of the three villages, Randa, St. Nicholas, and Visp. At Randa

(S. F. Survey, 4741 feet) I made six comparisons on three days, and the mean error of the aneroid came out 0·000. At St. Nicholas (S. F. Survey, 3678 feet) I took five readings on three days, and the mean error was −0·019 of an inch; and at Visp (S. F. Survey, 2165 feet) I took three readings on two days, and the mean error was −0·006.

I then thought it would be well to submit the aneroid to a sharp and sudden diminution in pressure, and took the train back to Zermatt to see what would happen through a rise of 3150 feet, made in 2 hrs. 20 min. At the last reading at Visp the error was −0·002 of an inch, and at Zermatt I found it was +0·011. On return to Visp, the mean error of five comparisons made on three days was +0·017 of an inch; at Sierre (S. F. Survey, 1765 feet), five readings on four days showed a mean error of −0·010, and the mean error of the last two comparisons, made at Geneva (S. F. Survey, 1227 feet), amounted to −0·030 of an inch. From September 9 to October 17 the aneroid was put in action forty-four times, and its loss upon the mercurial in that time amounted to 0·099 of an inch. A plus error of 0·069 of an inch at Zermatt was changed into a minus one of 0·030 of an inch at Geneva. This was equivalent to a loss of 0·00225 (or $\frac{225}{100000}$) of an inch on each occasion that it was used.

The remarkable nature of these figures will be apparent to any one who has acquaintance with the barometer, and especially to those who have used aneroid barometers in the field. Upon two occasions Colonel Watkin's instrument read so truly against the mercurial that I was unable to detect any discrepancy between the two instruments. At Randa, the mean of six readings gave as a result *no* error. Stress need not be laid upon these happy agreements. It is more to the purpose to draw attention to column G in the following table. If the eye is run down that column, and neglects the hundredths and thousandths of an inch, it will be seen that it reads 0·0 from first to last! Better results might have been attained, and I believe would have been attained, if the readings had been taken with greater rapidity. Attention must be paid to two points when employing this instrument. The first is to keep it constantly shut off from the influence of the atmosphere, except at the times when readings are to be taken; and the second is to take the readings as quickly as possible.

A Place of observation.	B Date. 1898.	C Altitude.	D Merc. bar. reduced to 32° F.	E Watkin's mountain aneroid.	F Number of observations.	G Mean error of aneroid.
		Feet.	Inches.	Inches.		Inch.
Zermatt	Sept. 3–8	5,315	25·006	25·096	21	+0·090
Top of Gugel ...	„ 9	8,882	21·963	22·020	1	+0·057
Riffelhaus	„ „	8,429	22·319	22·360	1	+0·041
Top of Gornergrat	„ „	10,289	20·872(?)	20·820	1	−0·052(?)
Zermatt	„ 10–13	5,315	24·912	24·980	8	+0·068
Top of Gornergrat	„ 13	10,289	20·729	20·717	3	−0·012
Zermatt	„ 13–14	5,315	24·917	24.947	2	+0·030
Randa	„ 15–17	4,741	25·687	25·687	6	0·000
St. Nicholas ...	„ 17–22	3,678	26·443	26·424	5	−0·019
Visp	„ 23–29	2,165	27·726	27·720	3	−0·006
Zermatt	„ 30	5,315	24·475	24·492	2	+0·017
Visp	Oct. 4–7	2,165	27·890	27·907	5	+0·017
Sierre	„ 9–12	1,765	28·131	28·121	5	−0·010
Genèva	„ 13–17	1,227	28·332	28·302	2	−0·030

Finally, I feel confident that, in the hands of those who will give the requisite attention, extraordinary results may be obtained from Watkin's mountain aneroid in observations made for altitude, and in determining differences of level.

The comparisons were made against a mountain mercurial barometer, Fortin principle, which was graduated to read on the vernier to $\frac{1}{500}$ of an inch, and by estimation could be read to $\frac{1}{1000}$. Before starting in July, this barometer was compared against its maker's standard, and it was found to have no error. On return in October it was again examined and compared, and it was found that it had not taken in any air.

The aneroid which was observed was 4½ inches in diameter, and was divided to 0·05 of an inch. Its scale ranged from 31 to 17 inches, and it weighed when in its leather sling case 2½ lbs. It was made by Mr. J. J. Hicks, 8, Hatton Garden. Aneroids of this type will be called Watkin's mountain aneroids, as they are especially devised for mountain travellers and for survey work amongst mountains.

EDWARD WHYMPER.

The Geographical Terms "Tirah" and "Afghanistan."

WITH your permission, I should like to be allowed to make a few remarks in correction of some errors contained in the "Tirah" article by Colonel Sir T. H. Holdich, C.B., which appeared in the October number of the *Journal*, and regret that I have been unable to address you before on the subject.

The word "Tí-ráh" has been known for centuries past as "*a geographical term*," and its original inhabitants, who were Tájzíks, and not of the Afghán race, are known to history as Tí-ráhís, who spoke a distinct language called Tí-ráhí after them. At the commencement of Akbar Badshah's reign there were no Afgháns in Tí-ráh, and the Afrídí Afgháns were then located elsewhere.

"*Afridistan*" is a recently coined English term, like "Kakuristan," "Wuzeristan," "Yaghistan," and the like, and is unknown to the people themselves.

At p. 354 of the article, the author says, "*Afghanistan, to begin with, is a name which we have applied to the kingdom ruled by the Amir. It is not a geographical term recognized by the Afghans.*" I can assure him, and also show him, that that geographical term has been known and recognized "from time immemorial" almost. It is constantly mentioned in history and geography *for the last eight hundred years and more*, as may be seen by referring to the history of Abu-l-Fazl-i-Baihaki, written in 1059 of the Christian Era, and in that of the Gardaizí, written a few years after; and so on, down to the present day, in every work almost, treating on that part. What "Afghánistán" means may be seen from my 'Notes on Afghánistán,' etc., pp. 453–468.

As to the statement that "*Afghan is not the ethnographical distinction of that people*," I can also show that it is used along with the term Afghánistán from the time these people are first mentioned in history, *just nine hundred years ago*, as proved from the writings of Al-'Utbí, in the "Táríkh-i-Yamíní," who was minister of the ninth Sámání ruler, Amír Núh, who ascended the throne in 957 A.D., and died 997.

Afgháns generally call themselves, particularly in their own country and among themselves, Pushtún and Pushtanah; and *those only*—whether at home or abroad—whose mother tongue is the Pushto, are Pushtúns or Afgháns. But the fact of speaking the Pushto language no more makes a man an Afghán than it makes an Englishman speaking Hindústání a Hindú. Some mongrel tribes, of little or no account, in the north-west of the Panj-áb, would greatly like to be accounted Patáns or Afgháns, which names refer to one and the same people.

"*The Afghans*" do not "*call themselves Duránis*;" only a portion of them do so. The Durránis are but an offshoot—but now become a very numerous one—of the Tarín Afgháns; and for centuries, and down to one hundred and twenty-fiv years ago, at the time of Ahmad Sháh, the Abdálí, who assumed the title o "Durr-i-Durrán," or "Pearl of Pearls," they were known only as the Abdális. Fro Ahmad Sháh's time they assumed the name of Durránís. The Abdális consist o three main divisions; the Sadozi, the royal division or sub-tribe; the Bárakzí to which the present Amir belongs; and the Alízí. All these contain numerou branches, and these *alone* constitute the Durráni Afgháns.

I may also mention that "Suwátí," "Buner-wál" (such a word as "*Bonerwhal*" is unknown), and "Bájawrí," are not the names of any tribes or portions of tribes of Afgháns, but are merely applied to those Afgháns who inhabit those tracts, just as the people who inhabit the Panj-áb are Panjábís, those of Sind, Sindís, and those dwelling in London, Londoners.

Respecting the geographical account of Tíráh, I have only to remark that it is not surprising that "neither Alexander, nor Mahmud of Ghazni, nor Baber (Bábar?), nor Ahmed Abdallah"—and Tímúr and half a score of others might be added—"were attracted to entangle themselves among the difficult passes about Tirah," when they had the choice of several far easier routes. "Ahmed Abdallah" is, unfortunately, unknown to fame. It is only the English who always choose the most difficult routes. I may mention, however, that the troops of Akbar Bádsháh traversed Tíráh in all directions from time to time, in pursuit of the schismatic—the "Mahdist," in fact—Pír-i-Roshán, *alias* Pír-i-Tárík, and his followers, among whom were the Tíráhí Tájzíks, from which period the ruin of the latter commenced, and they finally disappeared therefrom, and the Afrídí Afgháns, who are no more "*Rajputs*" than they are Turks, Greeks, or Chinese, first obtained possession of Tirah. See my 'Notes,' p. 391.

H. G. Raverty, Major.

November 10, 1898.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898-1899.

Second Ordinary Meeting, Monday, November 28, 1898.—Sir Clements Markham, K.C.B., President, in the Chair.

Elections.—*Louis J. Abrahams; Sir C. Thomas Dyke Acland, Bart.; Lieut. Henry S. L. Alford (Royal Scots Fusiliers); H. Aris, M.A. Cantab.; Rev. Arthur Baldwin; William Bruce Bannerman; Thomas Barron (Geological Surveyor to Egyptian Government); Hugh J. Llewellyn Beadnell; Charles Bethell; Lord Basil Blackwood; Frank M. Bladen; Lieut. H. Acton Blake, R.N.R.; Stanley Boyd, F.R.C.S.; Gilbert Edward Brooke, B.A. Cantab., L.R.C.P., L.R.C.S.; Edgar Brooks; Colonel Louis F. Brown, R.E.; Frank Thomas Bullen; John Butler, F.R.I.B.A.; John Campbell-Thomson, C.E.; John Kirk Child; Edwin Chill, M.D.; J. Lester Clark; W. W. Cobb, M.A. Oxon., F.C.S.; Norman Alexander Lindsay Cockell; Geo. Kynaston Cockerill (Lieut. 28th Punjab Infantry); John Boyd Coles; Rev. William Copeland; Captain Arthur Robert Denne (Indian Staff Corps); Lieut. H. De Prée (Royal Horse Artillery); Arthur Diósy; Rev. Frederick W. Barrow Dorset; Sievers Drewitt; Sir John Evans, K.C.B., D.C.L.; Thomas Ernest Preston Gardner; William Henry Gardner; Albert Edward Garrett; Edmund Johnston Garwood, M.A., F.G.S.: Captain Elmitt George (Antrim Artillery); William Henry Gleadell; Harry Good, C.E.; Gilmore*

Goodland; Rev. G. Golding-Bird, M.A.; Leonard Gorringe; Frederick H. Grinlinton (Surveyor-General of Ceylon); Captain Bertrand Evelyn Mellish Gurdon, D.S.O. (Indian Staff Corps); Count Leigh Hamong; Henry Handcock; Alfred Croven Harrison; Colonel H. H. Harvey-Kelly, I.S.C.; William Axel Herty; Dudley Francis Amelius Hervey; Wm. Tyrrell Osborn B. Hewett; Hiram Milliken Hiller, M.D.; James John Hills; Nicholas Hillyer; Francois Hopp; Commander William Van Sittart Howard, R.N.; John Hampden Jackson; J. W. Jamieson; Montague George Jessett; Heinrich Wilhelm Ferdinand Kayser; Rudolph Kohnstamm; George James Malcolm Kearton; Walter G. Klein; Roger Francis Lambe; Abraham Kingsley Macomber; Captain W. D. McSwiney (7th Dragoon Guards); Sam Mavor; Sidney Mayers; Robert Mitford, J.P.; Frederick Rice Markham; R. Dorsey Loraine Mohun; Robert Allan Moon; Lieut. Donald I. Munro, R.N.; Frank Naumann; Charles Albert Neuman; Charles Andrew O'Brien; Lieut.-Colonel C. S. Parsons, R.A.; E. Hope Pearse; John Wyatt Peters; G. Bettesworth Piggott; William Frederick Pocock; Captain S. H. Powell, R.E.; Captain John S. Purvis, R.E.; Julian Ralph; Arnot Reid; R. Nevill Roberts; T. J. Robertson; Robert W. Rogers, Ph.D., D.D.; William Sandover; Major-General G. H. Saxton; Leveson Edward Scarth, M.A.; Lewis Boyd Sebastian, M.A.; George William Shaw; Lieut. Hugh T. G. Stack, R.N.; Clement Locke Smiles; Edwin Smith; Lieut.-Colonel Edward Guy Selby Smyth; Surgeon-Major George Frederick Alexander Smythe (Army Medical Staff); Lieut. Richard Sparrow (7th Dragoon Guards); Alexander Young Spearman (1st Batt. Royal Warwicks); Captain E. A. Stanton (Oxfordshire Light Infantry); W. H. Stuart; Dimitri N. Tadros; Thomas E. Thickpenny; Lieut. C. Tylden-Pattenson, R.E.; Theodore Gustav Wanner; William J. E. Warring-Stone, M.A.; Prof. W. W. Watts (Mason College); Percy G. B. Westmacott; Arthur M. White.

The PRESIDENT said: The very long list of new Fellows we have heard read to-night is of course a subject of congratulation to us; not only are our numbers increasing rapidly, but the intelligent interest that the Fellows take in the work of the Society is also increasing rapidly, as shown by the numbers that come to consult our map collection. This year there have been a thousand more than there were last year, and last year there were a thousand more than the year before that.

The paper read was:—

"A Year on Christmas Island." By Chas. W. Andrews, B.SC., F.G.S.

Third Ordinary Meeting, December 12, 1898.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Lieut. P. B. Osborn (Oxford Light Infantry); George Rooke Penrose, M.B.; Lieut. T. E. Scott, D.S.O. (3rd Sikhs); Herbert G. Skill; Henry Watts.*

Mr. JOHN BARROW.

The PRESIDENT said: Before commencing the business of the evening, I cannot help alluding to the death of our old friend Mr. John Barrow, of which I have only just heard. He was the father of our Society, being the senior member, and he died at the great age of 91. In former years he was a very active member of the Society. He was the son of Sir John Barrow, in whose rooms at the Admiralty the committee met which formed this Society in 1830. John Barrow followed in his father's footsteps. He was secretary of the old Raleigh Club, which led to the founding of this Society, and he always took the deepest interest in it. Above all, he was the friend of naval officers, and many of them of an earlier generation owed a great deal to John Barrow, more especially all arctic officers, who received from him every sort of help and kindness.

The Paper read was:—

"Exploration in the Caroline Islands." By F. W. Christian.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciers. **Forel, Lugeon, and Muret.**
Jahrb. Schweizer Alpenclub **33** (1897–98): 249–261.

Les variations périodiques des glaciers des Alpes. Par Dr. F. A. Forel, Dr. M. Lugeon, E. Muret. Dix-huitième rapport. 1897. *With Map.*

Austria. *Nineteenth Century* **44** (1898): 957–970. **Lützow.**

The Bohemian Question. By Francis Count Lützow.

Austria—Earthquakes. **Becke.**
Sitzb. k. A.W. Wien **106**, Abth. I. (1897): 46–59, 103–116.

Mittheilungen der Erdbeben-Commission der kaiserlichen Akademie der Wissenschaften in Wien. II. Bericht über das Erdbeben von Brüx am 3 November 1896, von Friedrich Becke. *With Sketch-map.*—III. Bericht über das Erdbeben vom 5 Jänuer 1897 im südlichen Böhmerwald, von Prof. F. Becke. *With Sketch-map.*

Austria—Earthquakes. *Sitz. k. A.W. Wien* **106**, Abth. I. (1897): 467–486. **Mazelle.**

Mittheilungen der Erdbeben-Commission der kaiserlichen Akademie der Wissenschaften in Wien. IV. Bericht über die im Triester Gebiete beobachteten Erdbeben vom 15 Juli, 3 August und 21 September 1897. Von Eduard Mazelle.

Austria—Earthquakes. *Sitz. k. A.W. Wien* **106**, Abth. I. (1897): 20–45. **Mojsisovics.**

Mittheilungen der Erdbeben-Commission der kaiserlichen Akademie der Wissenschaften in Wien. I. Berichte über die Organisation der Erdbebenbeobachtung nebst Mittheilungen über während des Jahres 1896 erfolgte Erdbeben, zusammengestellt von Dr. Edmund v. Mojsisovics.

Austria—Hungary—Carpathians. **Uhlig.**
Sitz. k. A.W. Wien **106**, Abth. I. (1897): 188–206.

Ueber die Beziehungen der südlichen Klippenzone zu den Ostkarpathen. Von Prof. V. Uhlig. *With Maps.*

Austria—Moravia. *Deutsche Rundschau G.* **20** (1898): 529–538. **Trampler.**

Die Burghöhle im Punkwathale in Mähren. Von R. Trampler. *With Illustrations.*

On a number of caves in the Punkwa valley examined by the author in 1897. The illustrations include plans of the caves and drawings of bones found in them.

Austria—Poland. ——

Akademia Umiejętności w Krakowie. Sprawozdanie Komisyi Fizyograficznej. T. XXXII. w Krakowie, 1897. Size 9¼ × 6, pp. xviii., 232, 318, and 54. *Maps. Presented by the Academy of Sciences of Cracow.*

The first article contains a daily meteorological register for 1896 from a number of stations in Poland, the second is a flora of Poland, and there is also an article on the geology of some districts illustrated by maps.

Austria—Tyrol. **Battisti.**

Cesare Battisti. Il Trentino. Saggio di geografia fisica e di antropogeografia. Trento: G. Zippel, 1898. Size 10 × 7, pp. viii. and 326. *Map and Illustrations. Presented by the Author.*

This volume discusses the regional geography of the part of South Tyrol in the neighbourhood of Trient, with an orographical map of the surrounding district, and numerous photographs of mountain scenery.

Baltic Sea. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **15** (1898): 581–656. **Toose.**

Over de Oostzee en hare beteekenis voor Handel en Scheepvaart. Door W. Toose.

On the trade of the Baltic sea.

Belgium. *C. Rd.* **127** (1898): 641–645. **Martel.**

Nouvelles observations dans la grotte et la rivière souterraine de Han-sur-Lesse (Belgique). Note de M. Martel. *With Plan.*

British and German Trade. **Gastrell.**

Results of British and German Trade during the year 1897. Foreign Office, Annual No. 2040, 1898. Size 10 × 6½, pp. 12. *Price 1d.*

Bulgaria. *Z. Ges. Erdk. Berlin* **33** (1898): 201–253. **Cvijić.**

Das Rila-Gebirge und seine ehemalige Vergletscherung. Von Prof. Dr. J. Cvijić. *With Maps.*

Bulgaria. *Deutsche Rundschau G.* **21** (1898): 66–74. **Meinhard.**

Durch das Iskerdefilée. Von Friedrich Meinhard. *With Illustrations.*

Europe—Travel. ——

Cettinje to Windsor. Being an Account of the Visit of Nicolas I., Prince of Montenegro, to Her Majesty the Queen, May, 1898. By R. J. K. 1898. Size 7 × 5, pp. 72. *Illustrations. Presented by Messrs. Hatchard & Co.*

France. *C. Rd.* **127** (1898): 678–680. **Nicklès.**

Sur la tectonique des terrains secondaires du sud de la Montagne-Noire. Note de M. René Nicklès.

France—Corsica. **Joanne.**

Collection des Guides-Joanne. Itinéraire Général de la France. Par Paul Joanne. Corse. Avec un Appendice—La Corse à Bicyclette. Par M. A. Courtet. 6 Cartes et 3 Plans. Paris: Hachette et Cie., 1898. Size 6½ × 4½, pp. 18, lxxii., and 252.

France—Gironde. *B.S.G. Com. Bordeaux* **21** (1898): 320–330. **Hautreux.**

La Gironde de Pauillac à la mer, le passé, le présent. Par M. A. Hautreux. *With Maps.*

France—Havre. *Rev. G.* **43** (1898): 241–263. **Valleé.**

Le port du Havre. Par L. Vallée.

France—Lorraine. *Rev. G.* **43** (1898): 321–333. **Auerbach.**

La carte de Lorraine sous le duc Charles III. (Gérard Mercator, Hans van Schille, Thierry Alix). Par M. Bertrand Auerbach.

France—Nièvre. *B.S.G. Com. Bordeaux* **21** (1898): 352–359.
La vallée de la Nièvre. Par J. V.

The reason why this comparatively insignificant river was selected to give its name to a department is stated to be the great industrial importance of the region it waters at the close of the eighteenth century.

France—Pyrenees. *C. Rd.* **127** (1898): 740–742. **Delebecque and Ritter.**
Sur quelques lacs des Pyrénées-Orientales, des Hautes-Pyrénées et des Basses-Pyrénées. Note de MM. André Delebecque et Etienne Ritter.

France—Pyrenees. *Mém. S. Spéléologie* **3** (1898): 1–40. **Viré.**
Les Pyrénées souterraines (1re campagne, 1897). (Les Grottes de Bétharran, Escalère, Labastide, etc.) Par M. Armand Viré. ***With Plans and Illustrations.***

France—Southern. **Hall.**
The Romans on the Riviera and the Rhone. A sketch of the Conquest of Liguria and the Roman Province. By W. H. (Bullock) Hall. London: Macmillan & Co., 1898. Size 9 × 6, pp. x. and 194. ***Maps and Illustrations. Price 6s. Presented by the Author.***

After an introductory chapter, the author describes the military operations of Hannibal in the Rhone valley and his famous crossing of the Alps, and then goes on to consider the Roman invasion and occupation of southern Gaul, with a variety of illustrations of Roman buildings and a series of maps showing the actual configuration of parts of the coast and its former outline. The author deals in details with several disputed questions regarding routes.

Germany. *Deutsche Rundschau G.* **21** (1898): 61–66. **Herden.**
Die Bildung der norddeutschen Flusssysteme und ihrer Stromläufe. Von P. Herden. *With Map.*

On the development of the river-system of the North German plain.

Germany. *M. Ver. Erdk. Halle* (1898): 1–7. **Maenss.**
Die Teilung der Elbe bei Magdeburg in den neueren Jahrhunderten. Von Prof. J. Maenss. *With Maps.*

An account of the changes in the bed and course of the Elbe in the immediate neighbourhood of Magdeburg.

Germany. *M. Ver. Erdk. Halle* (1898): 104–187. **Schulz.**
Entwicklungsgeschichte der phanerogamen Pflanzendecke des Saalebezirkes. Von Dr. A. Schulz.

Germany—Frisian Islands. *Deutsche Rundschau G.* **21** (1898): 18–22, 75–80. **Axelsen.**
Die Nordfriesen. Von Postsecretär Peter Axelsen. *With Illustrations.*

Germany—Northern Plain. *G.Z.* **4** (1898): 481–508. **Keilhack.**
Die Oberflächenformen des norddeutschen Flachlandes und ihre Entstehung. Von Dr. K. Keilhack.

Germany—Thuringia. *M. Ver. Erdk. Halle* (1898): 80–97. **Reischel.**
Das thüringische Bauernhaus und seine Bewohner. Von Dr. G. Reischel.

Germany—Thuringia. *M. Ver. Erdk. Halle* (1898): 8–79. **Schulz.**
Die jährlichen Niederschlagsmengen Thüringens und des Harzes und ihre Verteilung auf die einzelnen Jahreszeiten und Monate. Von Dr. Fritz Schulz. *With Maps.*

Hungary—Budapest. **Körösy.**
Publicationen des Statistischen Bureaus der Haupt- und Residenzstadt Budapest. XXV. 3. Die Hauptstadt Budapest im Jahre 1891. Resultate der Volksbeschreibung und Volkszählung. Von Dr. Josef v. Körösy. Dritter Band. (Pp. 182 and 162).—XXVI. Die Sterblichkeit der Haupt- und Residenzstadt Budapest in den Jahren 1886–1890 und deren Ursachen. Von Dr. J. von Körösy. (Pp. x., 138, and 206.)—XXVII. Resultate der am 15. November 1896 durchgeführten Conscription der Bevölkerung Budapests. Von J. von Körösy.—XXVIII. Die Bauthätigkeit in Budapest in den Jahren 1885–1895. Von Dr. J. v. Körösy. Berlin: Puttkammer & Mühlbrecht, 1898. Size 11 × 8.

Hungary—Vital Statistics. **Körösy and Thirring.**
Die Natalitäts- und Mortalitäts- Verhältnisse Ungarischer Städte in den Jahren 1878–1895. Anlässlich des Budapester Internationalen Congresses für Hygiene und Demographie, auf Grund der im Budapester Communal statistischen Bureau gesammelten original Beobachtungen bearbeitet von Dr. Josef v. Körösy und Dr. Gustav Thirring. Budapest und Berlin, 1897. Size 9½ × 6½, pp. 116. *Presented by Dr. J. v. Körösy.*

Iceland. *Petermanns M.* 44 (1898): 217–222. **Keilhack.**
Aus dem nördlichen Island. Nach dem Reisebericht Dr. Th. Thoroddsens über den Sommer 1896. Von Dr. K. Keilhack. *With Map.*

Iceland. *G. Tidskrift* 14 (1898): 165–169. **Thoroddsen.**
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A summary of the chief results obtained by Dr. Thoroddsen during the last nine years.

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Le voyage d'Anthony Jenkinson dans l'Asie centrale en 1558. Par H. Conrad.

Asia—Historical. *J.R. Asiatic S.* (1898): 795–808. **Beames.**
The Geography of the Kandahár Inscription. By John Beames.

China. *Oesterreichische Monats. Orient* 24 (1898): 99–104, 113–119. ——
Die Aufstände in China.

China. *Questions Dipl. et Colon.* 4 (1898): 413–419, 457–463. **Fauvel.**
Les chemins de fer en Chine, dernières concessions. Par A. Fauvel. *With Map.*

China. **Hirth.**
Schantung und Kiau-tschóu. Von Friedrich Hirth. Sonderabdruck aus der Beilage zur "Allgemeinen Zeitung," Nr. 218 und 219 vom 27 und 28 September 1898. München, 1898. Size 8½ × 6, pp. 32. *Presented by the Author.*

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Geological Observations in Liautung, North China. By Kotora Jimbō. [In Japanese.]

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Trade of Chinkiang for the year 1897. Foreign Office, Annual No. 2187. 1898. Size 10 × 6½, pp. 8. *Price ½d.*

Chinese Empire. **Younghusband.**
Among the Celestials. A Narrative of Travels in Manchuria, across the Gobi Desert, through the Himalayas to India. Abridged from 'The Heart of a Continent.' By Captain Francis Younghusband. London: John Murray, 1898. Size 8½ × 6, pp. viii. and 262. *Map and Illustrations. Price 7s. 6d. Presented by the Publisher.*

This is the record of Captain Younghusband's great journey from Peking to India through Turkestan, supplemented by a special chapter on the present outlook in Manchuria. 'In the Heart of a Continent' was one of the best books of Asiatic travel, and the cheaper form, in which the most important part of it is here reproduced, should prove particularly welcome.

Chinese Geography. **Schlegel.**
Geographical Notes. III. Ho-ling Kaling. IV. Maliur and Malayu. V. Ting-ki-gi Ting-Gii. By G. Schlegel. Reprinted from the T'oung-Pao, vol. ix. No. 4. Leyden: E. J. Brill, 1898. Size 10 × 6½, pp. 26. *Presented by the Author.*

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The Northern Frontagers of China. By Sir Henry H. Howorth, K.C.I.E. Part x. The Uighurs of Kao-chang and Bishbaligh.

Chinese Turkestan. *Iz. Imp. Russian G.S.* 34 (1898): 185–204. **Uspensky.**
From Suidin to Urumtsi. By V. M. Uspensky. [In Russian.]

French Indo-China. **Girod.**
Miss. Catholiques 30 (1898): 54, 66, 78, 88, 101, 113, 125, 138, 148, 163, 173, 185, 196, 209, 221, 233, 246, 258, 270, 283, 294, 306, 319, 330, 341, 354, 365, 377, 390, 403, 414, 424.
Dix ans de Haut-Tonkin. Par M. Girod. *With Map and Illustrations.*

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La divination chez les Cambodgiens. Par M. Adhémard Lectère.

India—Anthropology. **Thurston.**
Madras Government Museum. Bulletin, vol. ii. No. 2. Anthropology. Eurasians of Madras and Malabar; Note on Tattooing; Malagasy-Nias-Dravidians; Toda

Petition. With Ten Plates. By Edgar Thurston. Madras, 1898. Size 8½ × 5½, pp. 69–130.

India—Bhotan. **Sandberg.**

Bhotan: the Unknown Indian State. By Rev. Graham Sandberg. (From the *Calcutta Review*, September, 1898.) Size 9 × 5½, pp. 28. *Presented by the Author.*

A summary of our knowledge of Bhotan, the only one of the Himalayan States with which there is absolutely no British intercourse.

India—Bombay. *J. Manchester G.S.* **14** (1898): 130–175. **Birdwood.**

The Recent Epidemics of Plague in Bombay. By H. M. Birdwood, C.S.I., etc. *With Map, Diagrams, and Illustrations.*

India—Botanical Survey. ———

Report of the Director of the Botanical Survey of India for the year 1897–98. [Calcutta, 1898.] Size 13½ × 8½, pp. 38.

India—Botany. *J. Linnean S. (Botany)* **34** (1898): 1–146. **Clarke.**

On the Subsubareas of British India, illustrated by the detailed Distribution of the *Cyperaceæ* in that Empire. By C. B. Clarke, M.A., F.R.S. *With Map.*

India—Burma. **Rigby.**

History of Operations in Northern Arakan and the Yawdwin Chin Hills, 1896–97, with a description of the Country and its Resources, Notes on the Tribes, and Diary. By Captain G. C. Rigby. Rangoon, 1897. Size 13½ × 9. *Maps and Illustrations.*

See *Journal* for May, vol. xi. (1898), p. 546.

India—Chitral. **Robertson.**

Chitrál, the Story of a Minor Siege. By Sir George S. Robertson, K.C.S.I. London: Methuen & Co., 1898. Size 9 × 6, pp. x. and 368. *Map and Illustrations. Price* 21*s.* *Presented by the Publishers.*

This is noticed in the *Journal* for December, 1898, vol. xii. p. 609.

India—Geological Survey. ———

General Report on the work carried on by the Geological Survey of India for the period from January 1, 1897, to April 1, 1898, under the direction of C. L. Griesbach. Calcutta, 1898. Size 10 × 7, pp. 80. *Presented by the Geological Survey of India.*

India—Kashmir. *Contemporary Rev.* **74** (1898): 872–881. **Bretherton.**

Life in Gilgit. By Captain G. H. Bretherton, D.S.O.

India—Ladak. *J. Manchester G.S.* **14** (1898): 1–23. **Shawe.**

Western Tibet. By F. B. Shawe. *With Illustrations.*

The author uses "Western Tibet," as distinguished from what he terms "Chinese Tibet," to designate the mountainous country of Ladak and Baltistan, and the paper deals exclusively with Ladak, where the author resided for some time.

India—Marine Survey. ———

Administration Report of the Marine Survey of India for the Official Year 1897–98. Bombay, 1898. Size 13 × 8½, pp. 12.

India—Tirah. **Holdich.**

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Indo-China. *B.S.G. Com. Paris* **20** (1898): 530–534. **Massieu.**

De Mandalay à Hué. Par Mme. I. Massieu. *With Map.*

The route led across from Mandalay to the Mekong, down that river to Savanmakat, and thence straight across to Hué.

Japan. **Hall.**

Trade of Hiogo and Osaka for the year 1897. Foreign Office, Annual No. 2189, 1898. Size 10 × 6½, pp. 24. *Price* 1½*d.*

Japan. *J.G. Tokyo G.S.* **10** (1898): 496–502. **Jimbō.**

On the Place Names in Hokkaidō. By Kotora Jimbō. [In Japanese.]

Japan. *J.G. Tokyo G.S.* **10** (1898): 153–159. **Koiwai.**

A Trip around the Noto Peninsula. By Kaneteru Koiwai. [In Japanese.]

Japan. *J.G. Tokyo G.S.* **10** (1898): 183–194. **Suzuki.**

Ashio Copper Mine. By Toshi Suzuki. [In Japanese.]

Japan—Formosa. *T. Asiatic S. Japan* **24** (Suppl.) (1896): 1-118. **Henry.**
A List of Plants from Formosa, with some Preliminary Remarks on the Geography, Nature of the Flora, and Economic Botany of the Island. By Augustine Henry.

Japan—Formosa. *J.G. Tokyo G.S.* **10** (1898): 357-364, 437-444. **Ishii.**
Geology of the Vicinities of Giran, and Geological Explorations at Taihoku, Taishū, and Tainan, in Formosa. By Yamajirō Ishii. [In Japanese.]

Japan—Formosa. *Petermanns M.* **44** (1898): 222-226. **Schuhmacher.**
Formosa und seine Gebirgsbewohner. Von Rob. Schuhmacher.

A brilliant description of the lowlands of Formosa, passing in review the country, the people, and its products.

Japan—Formosa. *J.G. Tokyo G.S.* **10** (1898): 419-427. **Torii.**
Aboriginal Tribes in Formosa. By Tatsuzō Torii. [In Japanese.]

Japan—Kurile Islands. *J.G. Tokyo G.S.* **10** (1898): 128-150, 205-214. ———
Works of Hōkōgikwai in Shumshu, Kurile Islands. [In Japanese.]

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Abyssinia. *J.R. United Service I.* **42** (1898): 1271-1298. **Fedoroff.**
Abyssinia as a Factor to be considered both in the Re-Settlement of the Soudán and in the Future of the Red Sea. By V. Fedoroff. Translated from the Russian by Lieut.-Colonel W. E. Gowan.

Africa. **Sanderson.**
Africa in the Nineteenth Century. By Edgar Sanderson. London: Seeley & Co., 1898. Size 8½ × 6, pp. vi. and 336. *Map and Portraits. Price 5s. Presented by the Publishers.*

This is a history of European intervention in Africa during the present century, much of the space being devoted to Egypt and to South Africa, and the description of military operations receiving special attention.

British West Africa. *J. Manchester G.S.* **14** (1898): 190-207. **Leonard.**
Notes of a Journey to Bende. By Major Arthur Glyn Leonard.

Cape of Good Hope. ———
Statistical Register of the Colony of the Cape of Good Hope for the year 1897, with supplement for March Quarter, 1898. Cape Town, 1898. Size 13 × 8½, pp. xviii. and 376. *Diagram. Presented by the Colonial Secretary, Cape Town.*

Congo State. ———
Société Royale de Médecine publique et de Topographie médicale de Belgique. Congrès National d'Hygiène et de Climatologie médicale de la Belgique et du Congo, du 9 au 14 août 1897, au Palais des Académies. Seconde Partie, Congo (Climat, Constitution du Sol et Hygiène de l'État Indépendant). Bruxelles: Hayez, 1898. Size 10 × 7, pp. 243-890. *Diagrams and Illustrations. Presented by the Société Royale de Médicine Publique de Belgique.*

This contains very comprehensive statistics of the climate, including the meteorological observations at the chief stations in the Congo State.

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Les animaux domestiques de l'Etat indépendant du Congo (mammifères et oiseaux).

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Ergebnisse meiner vierten ostafrikanischen Reise. Von Dr. Hans Meyer.

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The Future of Egypt: (1) Our Hampered Trusteeship. By Edward Dicey, C.B. (2) The Niger and the Nile: a Warning. By Henry Birchenough. (3) Egypt and Tunis: a Study in International Law. By John Macdonell, LL.D.

Egypt. *Cosmos* **12** (1894-96): 225-238. **Schiaparelli.**
La configurazione geografica dell' Alto Egitto, in relazione collo svolgimento della sua antica civiltà. Note di E. Schiaparelli.

Egypt. **White.**
England and Egypt. By A. Silva White. From the *Forum*, March, 1898. Size 10 × 7, pp. 59-71.

Egypt—Natron Lakes. *Jahrb. Schweizer Alpenclub* **33** (1897–98): 216–237. **Zeller.**

Ein Ausflug zu den Natronseen in der lybischen Wüste. Von Dr. Rudolf Zeller. *With Plate.*

A visit to the Wadi Natron in 1896. A coloured view of the Coptic monastery is given.

Egyptian Sudan. ———

Egypt. No. 2 (1898). Correspondence with the French Government respecting the Valley of the Upper Nile. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. iv. and 22. *Price 3d.*

Egyptian Sudan. *Nineteenth Century* **44** (1898): 1048–1054. **Maurice.**

Omdurman. By Major-General Frederick Maurice.

Egyptian Sudan. **Steevens.**

With Kitchener to Khartum. By G. W. Steevens. Second Edition. Edinburgh and London: W. Blackwood & Sons, 1898. Size 8 × 5½, pp. xiv. and 326. *Map and Plans. Price 6s. Presented by the Publishers.*

This is a remarkably vivid description of the incidents of the advance on Khartum, and incidentally of the characteristics of the portion of the Egyptian Sudan lying north of the capital. Mr. Steevens often succeeds by a phrase in giving an impression of the nature of the country more vivid than pages of detailed description could produce.

Egyptian Sudan—Bahr-el-Ghazal. *Mouvement G.* **15** (1898): 535–538. ———

La mission Marchand dans le Bahr-el-Gazal.

A sketch of the progress of Marchand's journey from Brazzaville, which he left on March 1, 1897, to the Nile.

Egyptian Sudan—Bahr-el-Ghazal. *Questions Dipl. et Colon* **5** (1898): 165–171. **Pensa.**

La France au Bahr-el-Ghazal. Par Henri Pensa.

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New Light on the Bahr-Gazal Frontier. By J. T. Wills. *With Map.*

Egyptian Sudan—Fashoda. *Questions Dipl. et Colon.* **5** (1898): 203–207. **Couronnel.**

Le "Blue Book" du Government Anglais sur Fachoda. Par M. le Comte de Couronnel.

Egyptian Sudan—Fashoda. *Fortnightly Rev.* **64** (1898): 665–676. **Decle.**

The Fashoda Question. By Lionel Decle. *With Map.*

French Sudan—Timbuktu. *Tour du Monde* **4** (1898): 409–432. **Réjou.**

Huit mois à Tombouctou et dans la région nord. Par M. le Commandant Réjou. *With Illustrations.*

French West Africa—Dakar. *B. Union G. Nord de la France* **19** (1897): 45–56. **Terquem.**

Le Port de Dakar. Par M. Henri Terquem.

This description of Dakar is compiled from the notes of a traveller who had visited the west coast of Africa on several occasions, and resided there.

French West Africa—Ivory Coast. *B.S. Languedoc. G.* **21** (1898): 60–66. **Eyssério.**

Voyage d'exploration à la Côte d'Ivoire. Par M. Eyssério. *With Map.*

French West Africa—Ivory Coast. **Westphal.**
B.S. Languedoc. G. **21** (1898): 11–29, 217–226.

La Côte d'Ivoire, son avenir industriel et commercial. Par M. Gustave Westphal.

German East Africa. *Deutsches Kolonialblatt* **9** (1898): 618–621. **Liebert.**

Bericht des Kaiserlichen Gouverneurs General-Majors Liebert über seine Reise nach Usagara und Uluguru.

German East Africa. *Verh. Ges. Erdk. Berlin* **25** (1898): 303–323. **Ramsay.**

Herr Hauptmann Ramsay: Ueber seine Expeditionen nach Ruanda und dem Rikwa-See.

German East Africa—Dar-es-Salaam. **Seidel.**

Dar-es-Salaam, die Hauptstadt Deutschostafrikas. Ein Kulturbild von A. Seidel. Berlin: Messer, Mensser & Co., 1898. Size 9½ × 6½, pp. 46. *Illustrations. Presented by the Author.*

Dar-es-Salaam has won the reputation of being the most handsomely built town in tropical Africa, and the description of its history and photographs of its public buildings here published are highly creditable to German colonial enterprise.

German South-West Africa. *Globus* 74 (1898): 249-251. **Gessert.**
Reise von Bethanien nach Garis im Namaland (Deutsch-S.W.-Afrika). Von Ferdinand Gessert.

German West Africa. *M. Deutsch. Schutzgebieten* 11 (1898): 183-186. **Besser.**
Bericht des Premierlieutenants v. Besser über seine Bereisung des Ndiangebietes im Jahre 1895.

A journey from the Rio del Rey to Cross river, on the German side of the boundary.

German West Africa—Kamerun. *Deutsches Kolonialblatt* 9 (1898): 498-504. ——
Bericht über die Bane-Bule-Expedition.

German West Africa—Kamerun. *M. Deutsch Schutzgebieten* 11 (1898): 208-211. ——
Die Höhe des Gipfels des Kamerungebirges.

A note on this paper was given in the *Journal* for November, p. 525.

German West Africa—Kamerun. *M. Deutsch. Schutzgebieten* 11 (1898): 194-204. **Conrau.**
Einige Beiträge über die Völker zwischen Mpundu und Bali. Von G. Conrau.

German West Africa—Kamerun. *M. Deutsch. Schutzgebieten* 11 (1898): 204-208. **Conrau.**
Von Mundame nach dem Berge Diungo. Von G. Conrau.

German West Africa—Kamerun. *M. Deutsch. Schutzgebieten* 11 (1898): 186-190. **Schnauder.**
Astronomische Ortsbestimmungen in Kamerun. Von M. Schnauder.

Indian Ocean. ——
Supplement, 1898, relating to Islands in the Southern Indian Ocean, westward of longitude 80° East, including Madagascar. 1891. Corrected to August, 1898. London: J. D. Potter, 1898. Size 10 × 6½, pp. 80. *Price 9d. Presented by the Admiralty.*

Madagascar. *C. Rd.* 127 (1898): 708-711. **Colin.**
Levés géodésiques, astronomiques et magnétiques à Madagascar. Note du P. Colin.

Describes the geodetic surveys carried out in Madagascar since 1896, and gives a certain number of positions fixed by astronomical observations.

Madeira. *Blackwood's Mag.* 164 (1898): 550-557. **Owen.**
Madeira Waterways. By Rye Owen.

A picturesque description of Madeira and the system of irrigation employed in the island.

Natal—Zululand. **Garrard.**
Report on the Mining Industry of Zululand, for the year 1897. By J. Jervis Garrard. Pietermaritzburg, 1898. Size 13 × 8½, pp. 70. *Sections. Presented by the Commissioner of Mines, Zululand.*

Describes in detail, with sections, the results of the year's prospecting for gold and coal in Zululand.

Portuguese East Africa—Delagoa Bay. *Globus* 74 (1898): 185-193. **Seidel.**
Die Ba-Ronga an der Delagoabai. Nach den Forschungen des Schweizer Missionars Junod geschildert von H. Seidel. *With Illustrations.*

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Peut-on et doit-on traverser le Sahara central en ballon? Par M. Léo Dex.

Sahara—Ghat and Aïr. **Schirmer.**
Le dernier rapport d'un Européen sur Ghât et les Touareg de l'Aïr (Journal de Voyage d'Erwin de Bary, 1876-1877) Traduit et annoté par Henri Schirmer. Paris: Librairie Fischbacher, 1898. Size 9 × 6, pp. 222. *Presented by Prof. Henri Schirmer.*

The translation of the journal kept by the German traveller, de Bary.

Sahara—Vegetation. *Naturw. Wochenschrift* 13 (1898): 517-520. **Schneider.**
Aus der Pflanzenwelt der Sahara. Von Camillo Karl Schneider.

A compilation from the works of explorers.

St. Helena. *A travers le Monde, Tour du Monde* 4 (1898): 297-300. **Lorin.**
A Sainte-Hélène. Par M. Henri Lorin. *With Illustrations.*

A visit to St. Helena by a special correspondent for the opening of the Congo railway.

St. Helena. **Sterndale.**
St. Helena. Annual Report for 1897. Colonial Reports, Annual No. 240, 1898. Size 10 × 6½, pp. 10. *Price* 1*d.*

South Africa. *Blackwood's Mag.* 164 (1898): 739–759. **Lawley.**
From Bulawayo to the Victoria Falls: a Mission to King Lewanika. By Captain the Hon. Arthur Lawley.

Spanish West Africa. *B.S.G. Madrid* (1898): 217–228. **Labra.**
La Guinea española y los problemas africanos. Según D. Rafael Maria de Labra.

NORTH AMERICA.

Canada—British Columbia. ——
The British Columbia Pilot, Second Edition, including the Coast of British Columbia from Juan de Fuca Strait to Portland Canal, together with Vancouver and Queen Charlotte Islands. London: J. D. Potter, 1898. Size 9½ × 6½, pp. xx. and 598. *Index Chart. Price* 5*s.* 6*d. Presented by the Admiralty.*

Canada—Yukon District. *Fortnightly Rev.* 64 (1898): 745–755. **Down.**
Adventurers at the Klondike. By T. C. Down.

Mexico. *B. Observatorio Astron. Nac. Tacubaya* 2 (1898): 135–141. **Puga.**
Posiciones geográficas determinadas con triangulación topográfica por la Comisión hidrográfica del Ayuntamionto de México.—1897–1898. Bajo la dirección del Ingeniero Geógrafo Guillermo. Por Puga.

Mexico. **Carden.**
Trade of Mexico and Tampico for the year 1897. Foreign Office, Annual No. 2184, 1898. Size 9½ × 6, pp. 18. *Price* 1½*d.*

Mexico. **Lummis.**
The Awakening of a Nation. Mexico of To-day. By Charles F. Lummis. New York and London: Harper & Brothers, 1898. Size 8½ × 5½, pp. xii. and 180. *Map and Illustrations. Price* 10*s.* 6*d.*

Glimpses of life in modern Mexico.

Mexico. **Romero.**
Geographical and Statistical Notes on Mexico. By Matias Romero. New York and London: G. P. Putnam's Sons, 1898. Size 10 × 6½, pp. xiv. and 286. *Presented by Señor Enrique J. Gonzalez.*

Mexico—Lower California. **Merrill.**
Notes on the Geology and Natural History of the Peninsula of Lower California. By George P. Merrill.—Report of the U. S. National Museum, 1895. Washington, 1897. Pp. 969–994. *Map and Illustrations.*

Mexico—Yucatan. **Thompson.**
Ruins of Xkichmook, Yucatan. By Edward H. Thompson. (Field Columbian Museum, Publication 28. Anthropological Series, vol. ii. No. 3.) Chicago, 1898: Size 10 × 6½, pp. 213–230. *Plans and Illustrations.*

An account of the detailed study of ruins discovered by the author in 1886 and fully worked out in 1896. The name he suggests is properly Xkichmul, a word meaning "between the hills," which corresponds with the position of the ruins.

North America—Historical. *Blackwood's Mag.* 164 (1898): 495–508. ——
Romance of the Fur Trade: the Companies.

North America—Tides. *National G. Mag.* 9 (1898): 403–409. **Jefferson.**
Atlantic Estuarine Tides. By Mark S. W. Jefferson. *With Diagrams.*

United States. *National G. Mag.* 9 (1898): 387–400. **Goode.**
Bitter Root Forest Reserve. By Richard U. Goode. *With Map and Illustrations.*

United States. **O'Beirne.**
Cattle Industry of the United States for two years ending June, 1898. Foreign Office, Miscellaneous, No. 481, 1898. Size 10 × 6½, pp. 25. *Price* 2*d.*

United States. ——
Annual Report of the Secretary of the Interior for the Fiscal Year ended June 30, 1896. 5 vols. (in 9). Washington, 1896–97. Size (vols. i.–iii. and v. [2 parts]), 9½ × 6½; (vol. iv. [4 parts]), 12 × 8, pp. (vol. i.) clvi. and 484; (vol. ii.) 972; (vol. iii.) 772; (vol. iv., part 1) xxii. and 1076; (part 2) xxvi. and 864; (part 3)

xxii. and 1058; (vol. v., 2 parts) lxxvi. and 2174. *Maps and Illustrations. Presented by the U.S. Government.*

The articles of geographical interest in these volumes are entered separately. Vol. ii. contains a map of the Indian reservations in the United States.

CENTRAL AND SOUTH AMERICA.

Argentine Republic—Aconcagua. **Fitz Gerald.**

Exploration on and around Aconcagua. By E. A. Fitz Gerald. From the *Geographical Journal* for November, 1898. Size 10 × 6½, pp. 26. *Map and Illustrations.*

Brazil. *Globus* **74** (1898): 121–124. **Steinen.**

Coudreaus Schingúreise. Von Karl v. d. Steinen.

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Brazil: its Commerce and Resources. By the Hon. T. L. Thompson. From the *Forum*, March, 1898. Size 10 × 7, pp. 46–58.

Central America. *Z. Ges. Erdk. Berlin* **33** (1898): 254–282. **Valentini.**

Pinzon-Solis. 1508. Von Ph. J. J. Valentini. *With Map.*

Cuba. *Fortnightly Rev.* **64** (1898): 507–526, 715–725. **Ramsden.**

A Diary at Santiago. By Frederick W. Ramsden. *With Map.*

Falkland Islands. **Craigie-Halkett.**

Falkland Islands. Annual Report for 1897. Colonial Reports, Annual No. 235, 1898. Size 10 × 6½, pp. 30. *Price 2d.*

French Guiana. *Rev. G.* **43** (1898): 161–179. **Froidevaux.**

Une visite aux îles du Salut (les îles au Diable) en 1763. Par M. H. Froidevaux. *With Map and Illustration.*

Honduras. *Verh. Ges. Erdk. Berlin* **25** (1898): 328–330. **Sapper.**

Herr Dr. Carl Sapper: Ueber seine Reise in Honduras.

Jamaica. **Stark.**

Stark's Jamaica Guide (Illustrated) containing a description of everything relating to Jamaica of which the Visitor or Resident may desire information, including its History, Inhabitants, Government, Resources, and places of interest to Travellers. By James H. Stark. Boston & London: Low & Co., [1898]. Size 8 × 5¼, pp. viii. and 208. *Maps and Illustrations. Price 6s.*

Nicaragua Canal. *Engineering Mag.* **15** (1898): 720–726. **Nimmo.**

The Nicaragua Canal in its Commercial and Military Aspects. By Joseph Nimmo, jr.

Paraguay. *Travel* **3** (1898): 222-228. **Hastings.**

To the Paraguayan Utopia. By the Rev. Fredk. Hastings. *With Illustrations.*

Patagonia. **Steffen.**

Informe sumario acerca del trascurso i resultados jenerales de la espedicion exploradora del rio Cisnes (en la Patagonia occidental). Por Dr. Juan Steffen. Santiago de Chile, 1898. Size 10 × 7½, pp. 30. *Map and Illustrations. Presented by the Author.*

A note on this paper appears in the *Journal* for December, 1898, vol. xii. p. 615.

Peru. *B.S.G. Lima* **7** (1897): 241–310. **Raimondi.**

Geografia fisica: Islas, islotes y rocas del Perú: Bahias y Puntas (de los manuscritos del señor Raimondi).

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Place-Names. *T.R.G.S. Australasia (Victoria)* **15** (1898): 33–47. **Wright.**

The Nomenclature of an Australian Colony. By A. J. Wright.

Australia. *G.Z.* **4** (1898): 508–520. **Jung.**

Die wirtschaftlichen Verhältnisse der australischen Kolonien. Von Dr. Emil Jung.

British New Guinea. *T.R.G.S. Australasia (Victoria)* 15 (1898): 12–15. **Beva**

The Discovery of the Aird and Purari Rivers. (Gulf of Papua, British New Guinea.) By Theodore F. Bevan. *With Map.*

British New Guinea. *T.R.G.S. Australasia (Victoria)* 15 (1898): 16–23. **Beva**

The Gold Rush to British New Guinea. By Theodore F. Bevan.

British New Guinea. **Macgrego**

Despatch from His Excellency the Lieutenant-Governor of British New Guinea, reporting Visit of Inspection to Western Districts of the Possession. No. 20. 1898. Size 13½ × 9, pp. 4. *Presented by the Colonial Office.*

Dutch New Guinea. *Petermanns M.* 44 (1898): 232–235. **Vrá**

Reise nach Neu-Guinea. Von E. St. Vráz.

Hawaii. **Krout.**

Hawaii and a Revolution. The personal experiences of a Newspaper Correspondent in the Sandwich Islands during the crisis of 1893 and subsequently. By Mary H. Krout. London: John Murray, 1898. Size 8½ × 5½, pp. xiv. and 332. *Illustrations. Price* 10*s.* 6*d. Presented by the Publisher.*

An informal history of the rise of the Hawaiian Republic, with descriptions of life in Honolulu, interviews with the last of the royal family, a visit to the famous volcano of Kilauea, and a sketch of the new constitution and of the resources of the country.

Hawaii. *B. American G.S.* 30 (1898): 277–280. **Littlehales.**

The United States Mid-Pacific Naval Supply Station. By G. W. Littlehales. *With Charts.*

The United States naval station, ceded by the King of Hawaii in 1884, is situated in the curious inlets of the island of Oahu, known as the Pearl Lochs, which are here described.

Hawaii. **Morgan.**

The Duty of annexing Hawaii. By John T. Morgan. From the *Forum*, March, 1898. Size 10 × 7, pp. 11–16.

New Guinea, etc. **Cayley-Webster.**

Through New Guinea and the Cannibal Countries. By H. Cayley-Webster. London: T. Fisher Unwin, 1898. Size 9½ × 6½, pp. xviii. and 388. *Portrait, Map, and Illustrations. Price* 21*s. Presented by the Publisher.*

POLAR REGIONS.

Antarctic. ——

The *Scottish Geographical Magazine.* Vol. xiv. No. 10, October, 1898. Special Antarctic Number. *With Map and Portrait.*

This number contains "A plea for a British Antarctic Expedition," by Sir John Murray; republishes the paper and discussion at the Royal Society's special Antarctic meeting; and gives a "History of Antarctic Discovery," by Mr. W. A. Taylor; an account of "The Fauna and Flora of the Antarctic," by Mr. James Chumley; and an "Antarctic Bibliography," by Mr. J. G. Bartholomew.

Arctic. *Cosmos* 12 (1894–96): 239–258. **Ryder.**

Condizioni dei ghiacci nel Mar di Groenlandia ed adiacenze, 1877-1892. Per Carlo Ryder. *With Maps.*

Arctic—Franz Josef Land. **Kœttlitz, Newton, and Teall.**

Quarterly J. Geolog. S. 54 (1898): 620–652.

Observations on the Geology of Franz Josef Land. By Dr. Reginald Kœttlitz. *With Diagrams.*

Additional Notes on Rocks and Fossils from Franz Josef Land. By E. T. Newton and J. J. H. Teall. *With Plate.*

Arctic—Jan Mayen. G. *Tidskrift* 14 (1898): 159–165. **Ostenfeld.**

En Nat paa Jan-Mayen. Af C. Ostenfeld. *With Map and Illustrations.*

On the visit of the *Ingolf* to Jan Mayen in 1896.

Greenland. G. *Tidskrift* 14 (1898): 169–172. **Ryberg.**

Fra Missions og Handelsstationen ved Angmagssalik. Af Carl Ryberg.

Greenland. *P. Literary and Philosoph. S. Liverpool* 52 (1898): 119–153. **Sephton.**

What the Sagas say of Greenland. By Rev. John Sephton, M.A.

Norwegian Arctic Expedition. *B.S.G. Com. Bordeaux* 21 (1898): 360-364. **Voll.**

La nouvelle expédition polaire norvégienne. Par Nils Voll.

An account of the equipment and crew of the *Fram* for the expedition to Northern Greenland on which Captain Sverdrup is now engaged.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Land Forms. *J. School G.* 2 (1898): 340-345. **Davis.**

The Selection of Topographical Maps for Schools. By W. M. Davis.

A list of topographical map-sheets of the U.S. Geological Survey, showing typical land forms and varieties of scenery.

Land Forms. *J. Geology* 6 (1898): 589-596. **Fairchild.**

Kettles in Glacial Lake Deltas. By H. L. Fairchild. *With Illustrations.*

After describing a large depression in a glacial delta at Potter, N.Y., the author points out that such basins may be produced either by the melting of a great block of buried ice, or by circumdeposition, and he proposes criteria for distinguishing between the two.

Land Forms. **Tarr.**

Wave-formed Cuspate Forelands. By Ralph S. Tarr. From the *American Geologist*, vol. xxii., July, 1898. Size 9½ × 6½, pp. 12. *Illustrations. Presented by the Author.*

Prof. Tarr, in demonstrating that some cuspate forelands are produced by wave-action, considers that it would be well to prove that the other causes which have been assigned for the production of these forms are really sufficient to produce the effects claimed for them.

Land Forms. **Tarr.**

The Peneplain. By Ralph S. Tarr. From the *American Geologist*, vol. xxi., June, 1898. Size 9½ × 6½, pp. 351-370.

The author joins issue directly with Prof. Davis as to the interpretation of the scenery which has led the latter to put forward his generalization of the action of river-erosion in reducing a region to the condition of a peneplain.

Meteorology. *Ann. Hydrographie* 26 (1898): 443-451. ———

Orkanartiger Sturm bei Kap Horn am 20 bis 22 April 1896. *With Diagrams.*

Meteorology. *Jahrb. Schweizer Alpenclub* 33 (1897-98): 292-300. **Bosshard.**

Elmsfeuer und Blitzgefahr im Gebirge. Von Dr. E. Bosshard. *With Plate.*

On the electric phenomena of high mountains, especially St. Elmo's fire and lightning.

Meteorology. *Ann. Hydrographie* 26 (1898): 451-462. **Haltermann.**

Einige Angaben über die im Spätherbst und Winter Südöstlich von den Azoren auftretenden Tiefdruckgebiete und deren Bedeutung für die Schiffahrt. Von Herm. Haltermann.

Meteorology—Upper Atmosphere. **Hann.**

Ueber die Temperatur des Obirgipfels (2140 m.) und des Sonnblickgipfels (3106 m.). Von J. Hann. Aus den Sitzungsberichten der kaiserlichen. Akademie der Wissenschaften in Wien. Mathem.-naturw. Classe, Bd. cvii. Abth. ii. a. Mai 1898. Wien, 1898. Size 10 × 6½, pp. 32. *Presented by the Author.*

At the observatory on the summit of the Sonnblick, in 47° 3′ N., and 10,190 feet above the sea, the mean annual temperature for eleven years was 26° Fahr., that of the coldest months (January and February), 6°·5 Fahr., and of the warmest (July), 33°·8. The highest temperature ever recorded on the summit was 55°·5, and the lowest − 30°·3.

Meteorology—Upper Atmosphere. **Riccò and Saya.**

Atti R.A. Lincei, Rendiconti 7 (1898): 103-111.

Osservazioni meteorologiche orarie simultanee, in quattro stazioni da Catania alla cima dell' Etna. Nota del A. Riccò e di G. Saya. *Diagrams.*

Hourly observations of the various meteorological data at four stations from sea-level to the summit of Mount Etna, for periods exceeding twenty-four hours on two occasions, July, 1897, and March, 1898.

Meteorology—Wind. **Hegyfoky.**
Mathemat. u. Naturw. Berichte Ungarn 14 (1898): 197–213.
Die unteren und oberen Luftströmungen über der ungarischen Tiefebene. Von J. Hegyfoky.

Observations on upper and lower cloud-movements in the great plain of Hungary, serving as indexes of the movements of the upper and lower strata of the atmosphere.

Ocean Currents. *B.S.G. Lima* 7 (1897): 311–314. **Balta.**
Un efecto geodinámico de la corriente antártica Americana. Por el ingeniero José Balta. *With Map.*

Oceanic Life. *Ann. Hydrographie* 26 (1898): 302–311. **Haltermann.**
Ueber gelbe Wasserblüthe des Meeres. (Trichodesmium.) Von H. Haltermann. *With Chart.*

A collection of instances in which yellow discolorations of the sea due to plankton were observed by the captains of German vessels.

Oceanic Noises. **Kain and others.**
Seismic and Oceanic Noises. By Samuel W. Kain and others. (Reprinted from the *Monthly Weather Review* for April, 1898.) Size 9 × 6½, pp. 6.

This is a contribution to our information regarding the unexplained noises known as *mistpoeffers*, *barisal guns*, etc., and suggests several possible explanations.

Oceanographical Methods. *Ann. Hydrographie* 26 (1898): 312–323. **Pettersson.**
Zur Methodik der hydrographischen Forschung. Von O. Pettersson.

Oceanography. *C. Rd.* 127 (1898): 731–733. **Boutan.**
L'instantané dans la Photographie sous-marine. Note de M. Louis Boutan.

On the methods of obtaining instantaneous submarine photographs.

Oceanography. *G. Tidskrift* 14 (1898): 151–159. **Knudsen.**
Ingolf-Expeditionens hydrografiske Undersøgelser. Af cand. mag. Martin Knudsen. *With Map.*

Oceanography. *Ann. Hydrographie* 26 (1898): 356–359. **Köppen.**
Jahres- Isothermen und -Isanomalen der Meeresoberfläche. Von W. Köppen. *With Chart.* [Also in *Globus* 74 (1898): 233–235. *With Chart.*]

On the temperature of the surface water of the ocean.

Oceanography. **Murray.**
On the Annual Range of Temperature in the Surface Waters of the Ocean, and its relation to other Oceanographical Phenomena. By Sir John Murray, K.C.B. (From the *Geographical Journal* for August, 1898.) Size 10 × 6½, pp. 26. *Chart.*

Oceanography. *Die Natur* 47 (1898): 427–429. **Zacharias.**
Die ozeanographischen Aufgaben der deutschen Tiefsee-Expedition. Von Otto Zacharias.

Preliminary results of the voyage of the *Valdivia.*

Oceanography—Red Sea. *Sitz. k. A. W. Wien* 106, Abth. I. (1897): 407–424. **Steuer.**
Vorläufiger Bericht über die pelagische Thierwelt des Rothen Meeres. Von Dr. Adolf Steuer. *With Map.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Brinton.**
The Factors of Heredity and Environment in Man. By Daniel G. Brinton, M.D. Reprinted from the *American Anthropologist*, September, 1898. Washington, 1898. Size 10 × 6½, pp. [8]. *Presented by the Author.*

Commercial Geography. *B. American G.S.* 30 (1898): 281–304. **Sears.**
Geographic conditions that make great Commercial Centres. By Major A. F. Sears.

The growth of cities in America is considered in the light of the various geographical conditions.

Commercial Geography—Coal Tables. ———
Copy "of Statement showing the Production and Consumption of Coal, and the Number of Persons employed in Coal Production, in the Principal Countries of

the World, in each year from 1883 to 1896, as far as the Particulars can be stated; together with a Statement showing the Production of Petroleum in the United States and in the Russian Empire for a series of years (in continuation of Parliamentary Paper No. 1, of Session 1897)." London: Eyre & Spottiswoode, 1898. Size 13 × 8½, pp. 54. *Price* 5½*d.*

Commercial Geography—Drugs. ——

Special Consular Reports. The Drug Trade in Foreign Countries. Vol. xiv. Reports from the Consuls of the United States. Issued from the Bureau of Foreign Commerce, Department of State. Washington, 1898. Size 9½ × 6, pp. 418.

Historical. **Gaffarel.**

Rev. G. **42** (1898): 54, 145, 463; **43** (1898): 58, 117, 219, 307, 381.

De orbe novo. Par Pierre Martyr d'Anghiera. Quatrième décade, traduite, avec notes et commentaires. Par Paul Gaffarel.

Historical—Portuguese Navigators. **Viterbo.**

Trabalhos Nauticos dos Portuguezes nos seculos xvi. e xvii. Parte i. Marinbaria. Memoria apresentada á Academia Real das Sciencias por occasião da celebração do 4°. Centenario do Descobrimento do caminho maritimo da India. Por Lousa Viterbo. Lisboa, 1898. Size 12 × 9, pp. 342. *Presented by the Author.*

Historical—Zeni. **Lucas.**

The Annals of the Voyages of the Brothers Nicolò and Antonio Zeno in the North Atlantic about the end of the Fourteenth Century, and the Claim founded thereon to a Venetian Discovery of America. A Criticism and an Indictment. By Fred. W. Lucas. Illustrated by Facsimiles. London: H. Stevens, Son & Stiles, 1898. Size 14 × 10½, pp. xiv. and 234. *Price £2 2s. Presented by the Publishers.*

This superb volume deals first with "the Story of the Book" of the voyages of the brothers Zeni, then with "the Story in the Book," and finally there are a Summary and Conclusions. The text is profusely illustrated with reproductions of ancient maps and quaint engravings. The appendices contain beautiful facsimiles of the Italian and English editions of the voyages, a bibliography, and a large number of reproductions of valuable old maps.

Political Geography. *G.Z.* **4** (1898): 397–408, 455–465, 520–525. **Hertzberg.**

Friedrich Ratzel's politische Geographie. Von Dr. Heinrich Hertzberg.

BIOGRAPHY.

Bolivar. *B.S.G. Com. Bordeaux* **21** (1898): 337–352. **Vincent and Humbert.**

Simon Bolivar; sa vie, son œuvre (1783–1830). Par le Dr. L. Vincent et J. Humbert.

A sketch of the life of the Liberator of South America.

Fitz Gerald. *Travel* **3** (1898): 338–339. ——

Mr. E. A. Fitz Gerald. *With Portrait.*

Giles. *T.R G.S. Australasia (Victoria)* **15** (1898): 96-99. ——

Mr. Ernest Giles.

Gümbel. *Deutsche Rundschau G.* **20** (1898): 572–573. ——

Karl Wilhelm v. Gümbel. *With Portrait.*

Dr. von Gümbel (1823–1898) was engaged largely in the study of the Alps from the point of view of geognosy.

Kerner. *Deutsche Rundschau G.* **21** (1898): 85-88. ——

Anton Kerner R. v. Marilaun. *With Portrait.*

Kiepert. *Deutsche Rundschau G.* **20** (1898): 569–571. ——

Heinrich Kiepert. Zu seiner achtzigsten Geburtstagsfeier. *With Portrait.*

Lista. *Deutsche Rundschau G.* **21** (1898): 42–43. **Greger.**

Ramon Lista. Von J. Greger. *With Portrait.*

Mason Bey. *B.S. Khédiv. G.* **5** (1898): 61–66. **Abbate.**

Mason Bey. Par le Dr. Abbate Pacha.

Colonel Alexander Macomt Mason, who died in March, 1897, was an American, who entered the Egyptian army and carried out many surveys in the Sudan.

6, 9, 11, 13, 15, 16; XLVI. 2, 4; XLVII. 2, 3, 10, 12; XLIX. 7; L. 4; LIII. 6, 8, 10, 11, 16; LVI. 2, 3, 4; LVII. 1, 2. **Staffordshire**, I. 12. **Surrey** (this county is now complete). **Sussex**, XIX. 10, 11, 13, 15; XXX. 2, 3, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16; XXXI. 1, 5, 6, 10; XXXII. 5, 9, 10; XLIII. 3, 4, 7, 8; XLIV. 1, 2, 3, 4, 5, 6, 7, 10; XLV. 1, 2, 5, 6, 12; XLVI. 6. **Westmorland**, IX. 16; XIV. 8, 12, 16; XV. 8, 9, 10, 11, 12, 13, 14, 15, 16; XVI. 1, 2, 5, 6, 7, 10, 11, 12, 13, 14; XVII. 9, 13, 14; XXIII. 1, 3, 4, 6, 7, 9, 15; XXIV. 1. 3*s. each.*

MISCELLANEOUS:—One-inch Parish Indexes, printed in colours, showing 25-inch parish maps only: Sheets 3, 12, 13, 33, 246, 256, 258, 267, 270. *Price* 1*s. each.* These are also published showing 6-inch quarter-sheets only, *price* 1s. *each.*

(E. Stanford, Agent.)

Turkey. **Goltz-Pascha.**

Karte der Umgegend von Constantinopel. Von C. Freiherr von der Goltz-Pascha. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Schall & Grund, Berlin, 1897. *Price* 4 *marks.*

ASIA.

China. **Bretschneider.**

Bretschneider's map of China: Supplementary maps.—1. Part of Northern Chile. Scale 1 : 755,000 or 10·3 stat. miles to an inch.—2. The mountains west of Peking. Scale 1 : 317,500 or 5·01 stat. miles to an inch.—3. Mid-China and the Yangtze river, in two sheets. Scale 1 : 2,050,000 or 32·3 stat. miles to an inch.—4. The great rivers of the Canton province. Scale 1 : 1,500,000 or 23·6 stat. miles to an inch.—5. Parts of Yunnan province. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. By A. Bretschneider. Engraved and printed by A. Iliin, St. Petersburg, 1898. *Presented by the Author.*

This is a series of maps supplementary to Bretschneider's four-sheet map of China. They are all drawn on different enlarged scales, suitable to the area shown on the sheet, and include some of the most important parts of the Chinese empire, among which the map of the Yangtse valley, on two sheets, has a special interest at the present time. It would have been an advantage if more altitudes had been given.

China. **Philip.**

The "Daily Mail" commercial map of China, showing the railway concessions, coalfields, iron-mines, navigable waterways, and steamship routes. Scale 1 : 7,750,000 or 120 stat. miles to an inch. George Philip & Son, London & Liverpool, 1898. *Price* 1*s. Presented by the Publishers.*

AFRICA.

French Congo. **Courtry.**

Carte du Congo Français et Haut Oubanghi. Scale 1 : 800,000 or 12·6 stat. miles to an inch. Par A. Courtry: Paris, 1897–98. 12 sheets.

The large scale on which this map is drawn renders it specially useful for reference. It is confined entirely to the basins of the Congo and Ubangi, and does not include any of the Bahr-el-Gazel province. The principal routes of explorers are laid down, and some statistical information with regard to navigation is given.

AMERICA.

Paraguay. **Romero.**

La République du Paraguay. Scale 1 : 1,580,000 or 24·9 stat. miles to an inch. By Cleto Romero. Bruxelles: E. Guyot, 1897.

This map was prepared for the International Exhibition of Brussels, 1897. The importance of towns is indicated by the symbols employed to mark their positions, and all railways and telegraph lines in operation, as well as those in the course of construction, are shown. An inset plan of Asuncion is given on an enlarged scale. At the back of the map there are notes containing statistical information.

AUSTRALASIA.

Queensland. **Survey Department, Brisbane.**

Map of Queensland. Scale 1 : 3,041,280 or 48 stat. miles to an inch. Survey Department, Brisbane, 1898. *Price* 2*s.* 6*d. Presented by the Surveyor-General of Queensland.*

GENERAL.

World. **Andree.**

Andrees allgemeiner Handatlas, 126 Haupt- und 139 Nebenkarten auf 186 Kartenseiten, nebst alphabetischem Namenverzeichnis. Vierte, völlig neubearbeitete, stark vermehrte Auflage, herausgegeben von A. Scobel. Lief 39, Südbayern, Tirol und Salzburg.—Lief 40, Schweiz.—Lief 41, Kolonial-und Weltverkehrskarte.—Lief 42, Uebersichtskarte von Afrika. Bielefeld und Leipzig: Verlag von Velhagen and Klasing, 1898. *Price* 50 *pf. each part.*

World. **Bartholomew.**

The Citizen's Atlas. One hundred maps and gazetteer. By J. G. Bartholomew, F.R.G.S. Published by George Newnes, Ltd., London. In 20 parts, issued fortnightly. Part 20. Price 6*d.*

With the issue of part 20 this atlas is complete, and contains altogether 120 maps, and many insets. It is a new and revised edition of Bartholomew's Library Reference Atlas, and has been issued with great regularity, in twenty fortnightly parts, at sixpence each. The price of the whole atlas, with the binding, is sixteen shillings, which, considering the excellence of the maps and the copious gazetteer which accompanies it, is remarkably cheap.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during September and October, 1898. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3014 m =	9·8	Scilly isles, St. Mary's pool. 6*d.*
2424 m =	0·5	Ireland, south coast:—Valentia to Kinsale. 3*s.*
3007 m =	1·4	Norway, south-west coast:—Haadyret to Rauna. 1*s.* 6*d.*
2967 m =	var.	Plans on the north coast of Russian Lapland:—Head of Pechinga gulf, Tzuip Vavolok bay, Vaida bay, Ozerko bay, Ozerko bay entrance. 1*s.* 6*d.*
1565 m =	3·9	Newfoundland:—Sops arm. 1*s.* 6*d.*
3009 m =	6·5 5·85	Newfoundland, east coast, anchorages in White bay:—Frenchman's cove, Purbeck cove, Jackson's arm, The narrows (Jackson's arm). 1*s.* 6*d.*
1605 m =	0·8	Lake Erie, eastern portion. 2*s.* 6*d.*
1516 m =	3·25	North America, east coast:—Boston harbour. 2*s.* 6*d.*
2938 m =	6·0 4·0	Anchorages on the coast of Chile:—Totoralillo bay, Huasco. 1*s.* 6*d.*
2093 m =	5·9	Chile:—Iquique. 1*s.* 6*d.*
1835 m =	1·35	Vancouver island:—Clayoquot sound, Shelter arm. 2*s.* 6*d.*
1235 m =	0·8 5·0	Persian gulf, mouth of the Euphrates:—Shatt al Arab and Bahmishir river, the bar below Mahammera. 2*s.*
1293 m =	0·7	Celébes:—Approach to Makassar. 2*s.* 6*d.*
3002 m =	0·85	China, south-east coast:—Bias bay. 1*s.* 6*d.*
1988 m =	0·75	China:—Sam sa bay and inlet. 2*s.*
16 m =	11·0 10·0 9·0	Japan:—Kobe and Osaka, Sakai Ko, Aji Kawa Guchi. 2*s.*
3018 m =	2·0	Anchorages on the north-west coast of Australia:—Point Cloates anchorage, Maud landing. 1*s.* 6*d.*
1663 m =	3·4 4·5	New Zealand:—Poverty bay, Gisborne. 1*s.* 6*d.*
1022		New Plan:—Antipodes islands. Plan added:—Depôt anchorage.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
2424	Valentia to cape Clear.	New chart. Valentia to Kinsale	2424
1996	Mizen head to Kinsale.		
883	Plan of approaches to Ekersund on this sheet.	New Chart. Haadyret to Rauna	3007
2333	Plans of Port Novoi Zemli and Vaida bay on this chart.	New Chart. Plans on the north coast of Russian Lapland	2967

No.		Cancelled by	No.
1565	Sops arm.	New chart. Sops arm	1565
678	Plan of Rondeau harbour on this sheet.		
2871	Boston harbour.	New chart. Boston harbour	1516
1302	Plans of Totoralillo bay and port of Huasco on this chart.	New chart. Anchorages on the coast of Chile	2938
1278	Plan of Iquique road on this chart.	New chart. Iquique	2093
601	Plan of Isles do Los on this chart.		
1235	Mouth of the Euphrates.	New chart. Mouth of the Euphrates	1235
1293	Approach to Makassar.	New chart. Approach to Makassar	1293
1988	Sam sa bay and inlet.	New chart. Sam sa bay and inlet	1988
16	Hyogo and Osaka.	New chart. Kobe and Osaka	16

Charts that have received Important Corrections.

No. 2280, White sea:—Arkhangel bay. 300, Anchorages on the west and north coasts of Spitsbergen. 2361, Sweden:—Öland to Landsort. 2296, Gulf of Bothnia:—South Quarken to Hornslandet. 2331, Gulf of Finland:—Hangö head to Barö sound. 1345, France, west coast:—St. Jean de Luz. 2647, France, west coast:—Les Sables d'Olonne to Bourgneuf. 2646, France, west coast:—Borgneuf to Ile de Groix. 194, Malta and Gozo islands. 2996, Black sea:—Karkinitskago bay. 2282, Arctic ocean and Greenland sea. 296, Newfoundland:—Cape Bonavista to Bay Bulls. 678, Lake Erie and Huron. 1302, Plans on the coast of Chile. 1876, Anchorages on the coast of Mexico. 2449, British Columbia:—Lama passage and Seaforth channel. 2431, Alaska:—Port Simpson to Cross sound. 1013, Africa, west coast:—Cape Lopez to Cape of Good Hope. 601, Africa, west coast:—Isles do Los to Sherbro island. 685, Africa, east coast:—Bazaruto bay, Limpopo river. 721, Seychelles group. 42, India, west coast:—Coasts of Sind and Kutch. 829, India, east coast:—Cocanada to Bassein river. 814, Bay of Bengal:—The Sandheads. 2636, Strait of Makassar, north part. 403, Australia, south coast:—Wood point to Lowly point. 401, Australia, south coast:—Port Augusta.
(*J. D. Potter, Agent.*)

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Pacific Ocean for December, 1898. Published at the Hydrographic Office, Washington, E.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

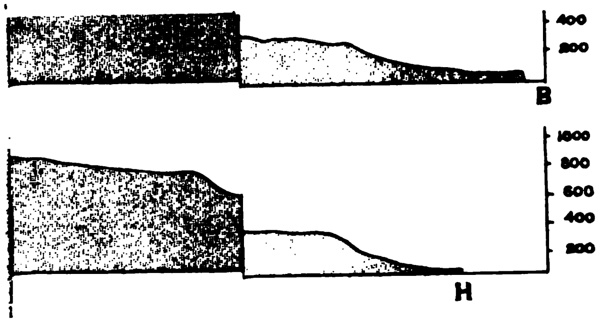
Alaska. **Burls.**

Five Photographs of the Robinson Range, Alaska (Mounts Dalton, Redwood, and Campbell), taken by H. T. Burls, Esq., 1898. *Presented by H. T. Burls, Esq.*

These five photographs are enlargements, and illustrate the scenery and geology of the Robinson range, Alaska. The following are their titles:—

(1) Mount Redwood, with Johnstone creek in the foreground; (2) Mount Redwood, about 6 miles west from Icy cape; (3) Mount Redwood, showing glacier becoming extinct at foot; (4) Mount Campbell; (5) Mount Dalton.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.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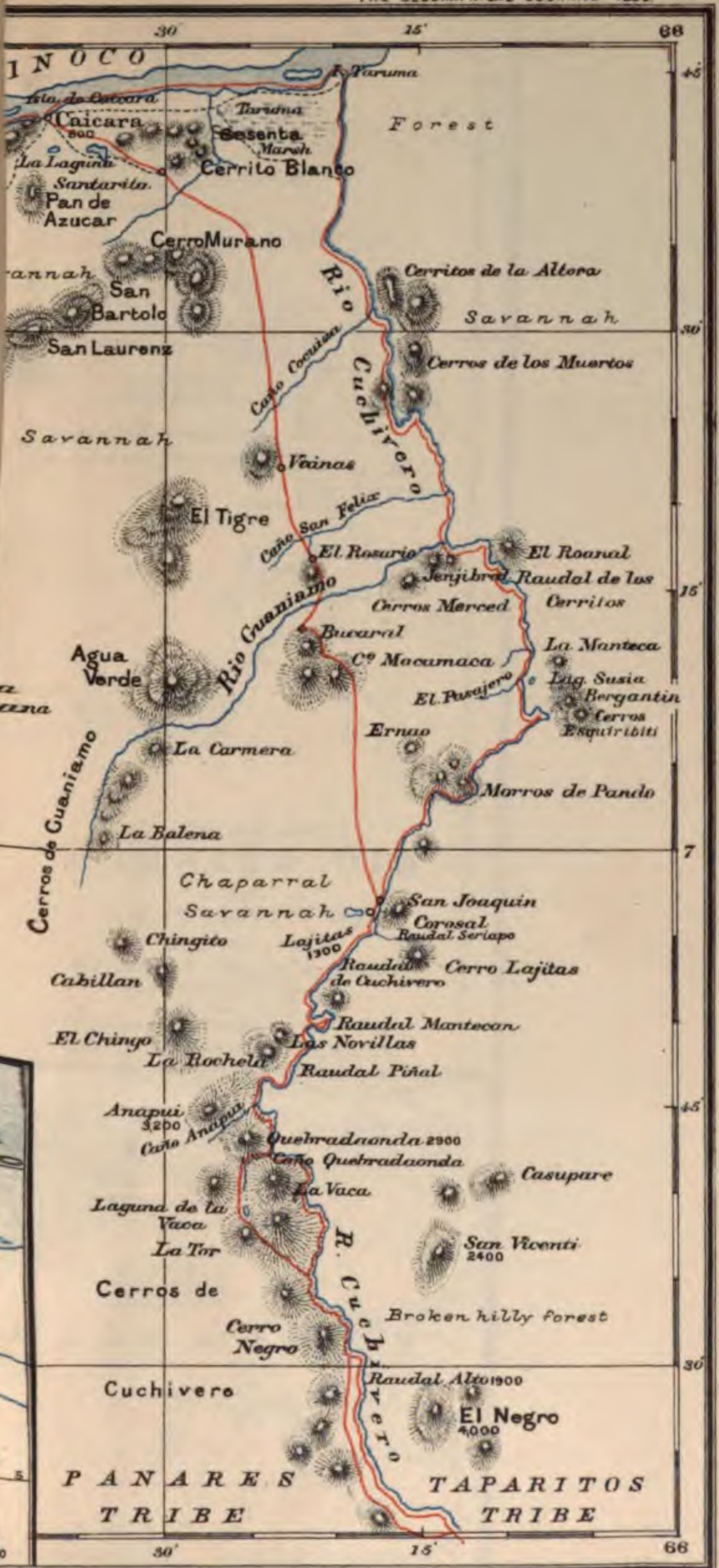

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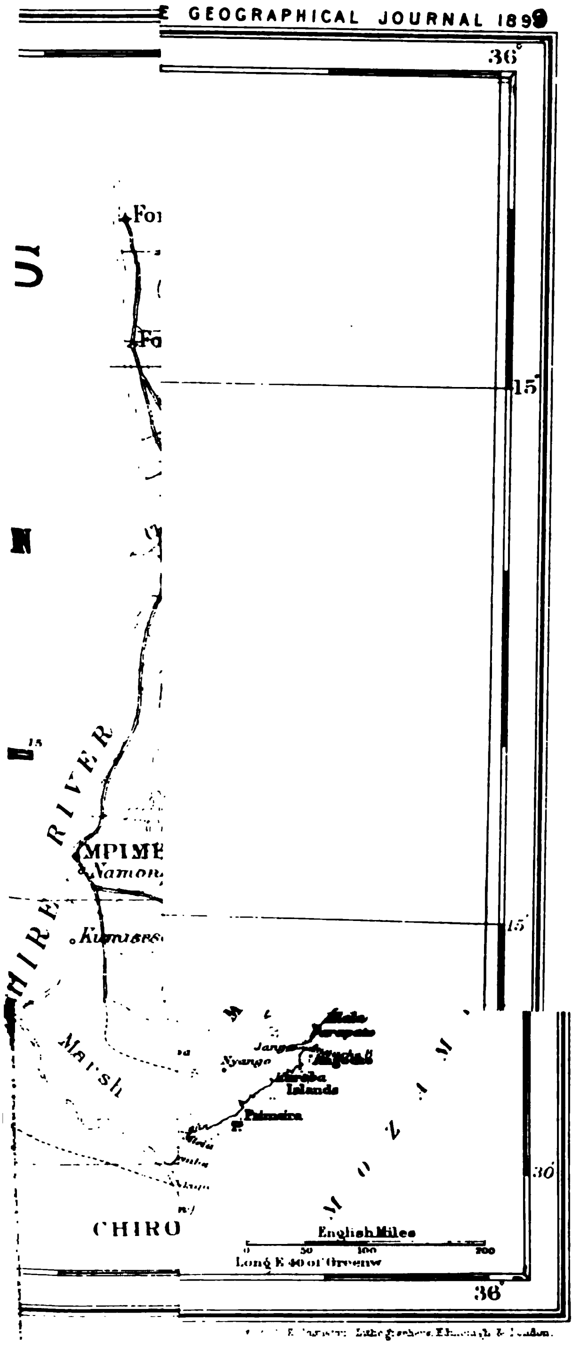
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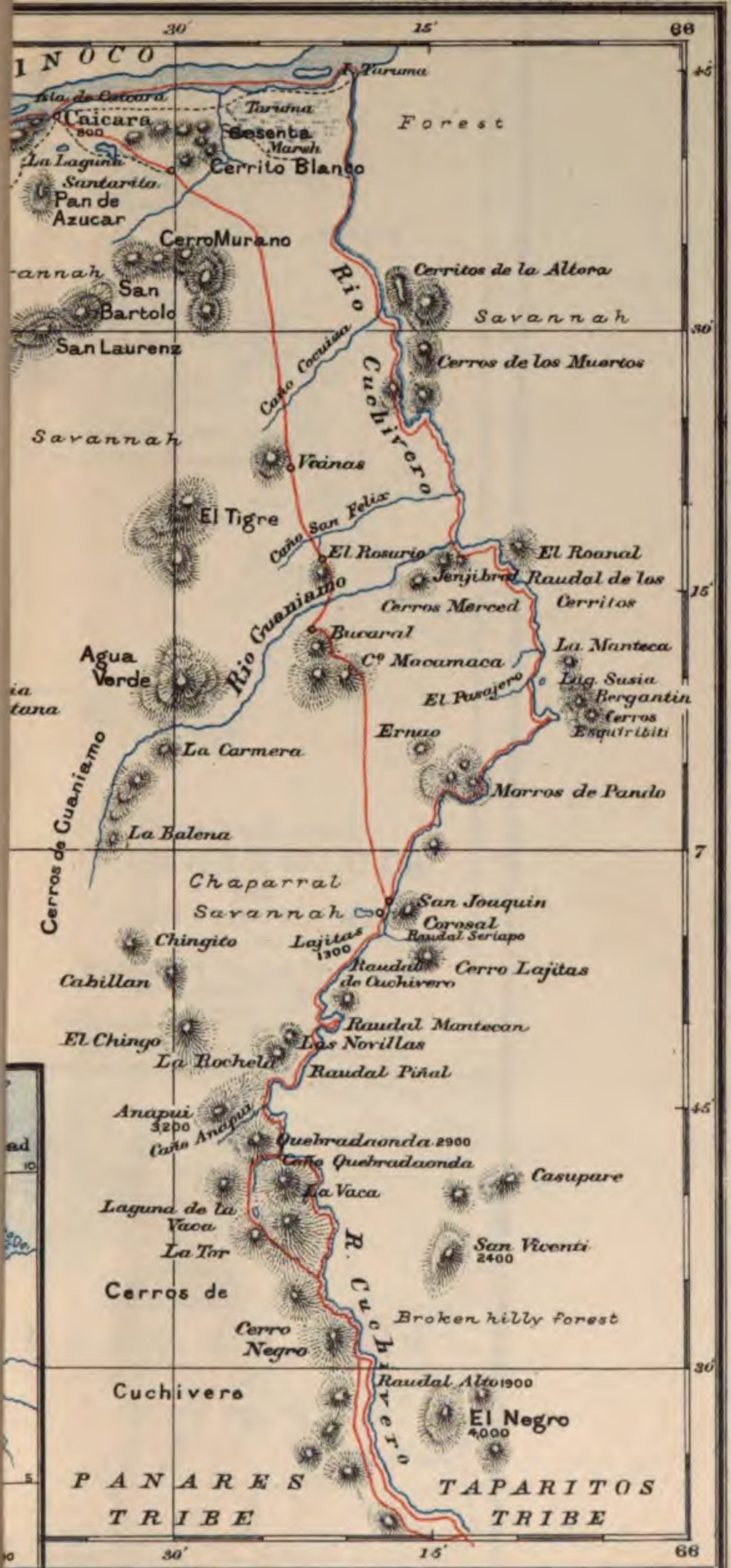

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EXPLORATION IN THE CAROLINE ISLANDS.*

By F. W. CHRISTIAN.

The extensive Caroline archipelago stretches for over 1500 miles from Yap in the west, to Kusaie in the east, and lies north of New Guinea (between lat. 5° to 10° N., and long. 137° 30′ and 163° 10′ E.). It is a collection of low coral atolls, with a sprinkling of basalt islands enclosed by barrier reefs. These and other coralline groups so thickly stud the waters hereabouts, that geographers have given this portion of the Pacific the name of Micronesia—the region of the little islands. The Marianne or Ladrone group, practically a prolongation of the Japanese chain, is not properly reckoned in the Micronesian area. The Caroline archipelago is composed of thirty-six minor groups, of which the following are the principal: Yap, Uluthi, Uleai, Namonuito, Pulawat, Ruk, the Mortlocks, Ponape, and Kusaie. Altogether there are 680 islets and islands, for the most part sparsely inhabited, the population probably not exceeding 50,000, an odd medley of the black, brown, and yellow races. It is a curious fact that, although Yap lies some 1500 miles nearer India and the Malay archipelago than Ponape, the westernmost islanders are much the darker and their language the more strange and barbarous. The great stream of Polynesian migration has flowed past further southward. Yet the dialect of Uluthi to the north of Yap, like that of the central Carolines, has a considerable Polynesian infiltration. These jagged or indented areas of speech are a peculiar puzzle to the philologist, showing a very irregular distribution of race-mixture. The islanders of Uleai, Lamotrek, Ifalik, and Satawal are closely allied in speech, customs, and traditions to those of Uluthi.

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* Paper read at the Royal Geographical Society, December 12, 1898. Map, p. 224.

The islands in the great lagoon of Hogolu or Ruk, further to the eastward, are occupied by two mutually hostile races, the black and the brown, who are constantly at war with one another. Next to Ruk are the Mortlock islands, divided into three minor groups, of which Lukunor is the largest and most populous. The Mortlock dialect is the Lingua Franca, or commercial language of the archipelago, furnishing a most complete key to the bizarre dialects that cover this extreme area. South of the Mortlocks, and about 100 miles north of the line, are two interesting little coralline groups named Nuku-Or and Kap-in-Mailang, or Kap-en-Marangi. On these is spoken a language, a remarkable monument of pure and archaic Polynesian, combining the phonesis of Tahitian and Samoan, with a sprinkling of later Malayan. The coralline islands, which form by far the larger proportion of the Caroline group, rarely rise more than 20 or 30 feet above the sea; but the islands of mingled basaltic and limestone formation, such as Yap in the west, Ruk in the centre, Lukunor a little to the east, and Ponape and Kusaie in the extreme east, rise to an altitude varying from 600 to nearly 3000 feet. The special interest attaching to these little spots is fourfold—

1. To the geographer, because the group affords some interesting studies in the formation of coral reefs found in all stages of development, and the presence of columnar and cellular basalt.

2. To the student of history, for the trouble that arose in 1886 between Spain and Germany over the possession of the Carolines, with their trading possibilities.

3. To the archæologist, for the existence of certain massive structures of stone upon the islands of Ponape and Kusaie, to the eastward of the chain.

4. To the philologist, for the study of many curious native dialects hitherto unclassified, the distribution of which shows clearly the steady progress eastward and southward of the so-called Malayo-Polynesian nations, illustrating a singular race fusion worked out for many centuries past between trader, explorer, fugitive, castaway, exile, and pirate—streams of overlapping populations flowing wave upon wave, backwater, eddy, and counter-current.

I will refer briefly to the principal explorers who have visited these waters.

In 1528, Alvaro de Saavedra discovered the Uluthi or Mackenzie group, and took possession of them in the name of Spain. A little later he sailed into the wide lagoon of Hogolu, or Ruk, and in the September of the next year he found Ualan, or Kusaie. After him Villalobos and Legaspi, on their way to the Philippines from New Spain, made fresh discoveries in these waters, of which Yap was the most important.

In 1595, the famous sea-captain Quirós fell in with Ngatik, to the south of Ponape, which he called Los Valientes, from the warlike character of the natives he found there. A series of expeditions of a religious character followed the Spanish discoveries in these seas.

Attempts to introduce the Catholic faith on Sonsorol and the Enderby group, known as Los Martires, failed disastrously, ending in the death of the missionaries who conducted them, through the cowardice and incompetence of the captain who held temporal command. Other Spanish vessels, no doubt, on the course from Acapulco to the Philippines, may have fallen in with some of the Caroline islands or been wrecked on some of the uncharted reefs. Of these we have no record save the grim story on the south coast of Ponape, of iron men who came up out of the sea and fought with the men of Kiti, until overwhelmed with sling-stones and spear-thrusts. A voyager of note in Micronesia was Kotzebue, who, with the famous Chamisso, poet, dramatist, and philologist, visited the Marshalls, the Mariannes, and a portion of the Carolines in 1815. After 1819, Lutke, Freycinet, Duperrey, and Dumont D'Urville visited these regions. In 1839, an English man-of-war, the *Larne*, coasted around Ponape and entered Kiti harbour. A number of geographical observations and soundings were taken, upon which our present Admiralty chart is based. Most unfortunately, nearly all the native names have been cruelly mangled, and have become a meaningless jargon.

Dr. J. S. Kubary—now unhappily deceased—made some interesting researches amongst the Mortlock islanders, and supplied new information on the bird-life of Ponape. He also furnished the Godefroy firm at Hamburg with some notes on the ruins of Metalanim. When I met him he was living at Inpompo, on the south bank of the Pillap-en-Chakola creek, a little way above the colony of Santiago. He was then busily engaged collecting land-shells and specimens of birds of the island, one of which, a *Phlegyas*, was called after him. I did not have the pleasure of seeing the beautiful views he took of Nan-Matal in 1874, or of examining in detail his writings on the ruins of Metalanim. He, however, let me have the plan of the ruins of Nan-Matal, of which I have made use, making a good many corrections in the names and a little in the position of the islets, from the information given by some natives and an old American settler and his son, who accompanied me. Before my visit to Metalanim, Kubary promised to give me a full account on my return, so that I could have the satisfaction of working independently. When I came back he told me a good deal more about his work, and we had very interesting discussions together. Strangely enough, he had not made any excavations in the central vault, which he had used as a developing-chamber for his negatives, and was delighted when I spread my finds before him. As an instance of the thoroughness of his methods, I refer to the sketch-plan of Nan-Tauach, at p. 8 of the paper on Kubary's researches by Dr. Friedrichsen, "Die Ruinen von Nan-Matal," published in Hamburg in 1874, [in the journals of the Museum Godeffroy,] which has done so much for science in Pacific waters. A little while after my departure from Ponape, I received a letter at Yap telling me of Kubary's death, which occurred only two days after

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my departure. He was one of the most indefatigable scientists that Germany has sent out into Pacific waters, and was much missed by all who knew him.

During his cruises in the Pacific in 1882–85, Admiral Cyprian Bridge visited the Carolines (*Proceedings*, *R.G.S.*, 1886). Mr. Moss, now British resident of Rarotonga, paid a brief visit to Metalanim about twelve years ago, which he mentions in his book entitled 'Atolls and Islands.' An American missionary, Dr. Gulick, also took some valuable notes on the people of Ponape and their antiquities, published in Boston about 1875.

In 1885, the raising of the German flag at Yap by the cruiser *Iltis* caused much indignation at Madrid, Spain finally being confirmed in her possession by the friendly intervention of the Pope. Ever since, Spain has found the islands a troublesome acquisition. She has squandered many lives in quelling native risings, and is obliged to keep up two expensive military establishments, one at Yap in the west, the other at Ponape in the east. She gets no return from the natives in revenues or taxes, and the trading is monopolized by Germans, Americans, and Japanese, who make a very fair livelihood in dealing with the exports. These consist of copra, bêche-de-mer, vegetable ivory nuts, turtle-shell, and pearl-shell. The copra exported annually from the Carolines is calculated at 4,000,000 lbs. weight, towards which the island of Yap yields 1,800,000 lbs.

In 1895, meeting in Sydney Louis Becke, that Ulysses of Pacific waters, I determined to take his advice and visit Spanish Micronesia, in order to explore some remarkable ruins reported upon the islands of Ponape and Lele, in the Eastern Carolines. On my way out I made a brief stay at Hong-Kong, where Sir William Robinson, the Governor, was so kind as to furnish me with credentials to General Blanco at Manila, then Spanish Governor of the Philippines. He, in turn, gave me letters to the two deputy governors on Yap and Ponape, the respective seats of government in the extreme west and east of the Carolines. I left Manila in the bi-monthly mail-steamer *Venus* on December 15, touching at Yap December 22, Guam in the Ladrones on Christmas Day, and reaching Ponape on the first day of the New Year, 1896. I took with me, as photographer and general assistant, a Philippine native from the province of Pampanga, since executed by the Spaniards for joining in the late rebellion. Whilst he was with me on Ponape he took some 150 photographs in the various districts. Soon after our arrival, the powerful chief Nanapei of Ronkiti, on the south coast, gave us the island of Nalap as our first base of operations. Here we stayed three months, studying the language and customs of the natives, and taking many notes on the marine life. Subsequently we spent the month of March in the Metalanim district on the east coast, where we visited the walled islands of Nan-Matal and the sanctuaries of Nan-Tauach and Pankatara. After leaving Nan-Matal I visited an ancient cemetery on the Metalanim border, of which I took a sketch plan.

Returning to Ascension bay in May, I made a voyage down to the south-east, visiting Mokil, Pingelap, and Strong's island—otherwise called Ualan, or Kusaie—where I sketched a plan of a remarkable Cyclopean enclosure upon the island of Lele. On my return to Ponape, I stayed five months on the island of Paniau, off the mouth of the Kiti river, watching with great interest the operations of a bêche-de-mer fishery, and making various excursions. In October I left by the mail steamer *Uranus* for Yap, where I stayed until well on in December, when I left in a sailing-vessel, which brought me up through the China seas to Hong Kong.

The area of the island of Ponape is some 340 square miles. It is surrounded by a barrier reef enclosing a lagoon about a mile and a half in breadth, and of varying depth, studded in all directions with detached reefs, and patches of live coral, the rapid growth of which on the south and south-west coasts bids fair to render navigation—except for the lightest canoes—an impossible task. On the north coast, however, the lagoon in many places is of considerable depth. In this lagoon are scattered thirty-three islets, mostly low and of coralline formation; a few of them, however, are volcanic in origin.

Chokach has a remarkable scarp or precipice, the *Paip-Alap*, 937 feet in height, on the north side of it, where the columnar form of the basalt is very clearly defined. The glen below, tradition declares, was the quarry whence the early builders gathered the material for their wonderful buildings on the east coast, straight from the workshop of Nature. Langar is the headquarters of a German trading firm.

The other islands are somewhat thinly populated, and serve merely as fishing stations. The islet of Mutakaloch, off the Metalanim coast, is remarkable for its cellular basalt formation; whilst near Kapara, which lies on the edge of the barrier reef on the south-west coast, is seen the phenomenon of a spring of fresh water welling up through the coral.

The principal harbours are five in number: (1) Ascension bay in the north, at the mouth of the Pillapenchakola river, on the west bank of which stands the little Spanish colony of Santiago, with the peaks of Kupuricha and Telemir towering some 2000 feet high in the background. To the south-west is the great scarp of Chokach, a notable landmark far out at sea. (2) Port Aru, or Oa, on the U and Metalanim border, was the scene in 1890 of a brisk action, in which the Spaniards brilliantly carried the rebel defences from the sea. (3) Metalanim harbour on the east, overlooked by Mount Takai-U, or the Sugar-loaf peak, in the neighbourhood of which are the celebrated ruins. (4) Port Mutok, called after the double-peaked basaltic islet lying inshore—the *Tenedos* of Lütke—at the mouth of the Kiti river, with the peaks of Roi, Lukoila, and Wana in the background, with a remarkable obelisk-shaped rock, called by the native Chila-U, or the Adze-head, and by trading skippers, the "Sentry Box." (5) Ronkiti harbour, at the mouth of the river of the same name, which rises in the slopes of Mount Tolokom, the highest peak in the island, judged to be about 2860 feet high.

The island is divided into five districts, U, Chokach, Not, Kiti, and Metalanim; the two latter with a population of 1300 and 1500 respectively. The whole population is about 5000, living in Kanim or scattered open villages confined to the sea-coast. They are Christianized, though secretly retaining many of their old heathen practices. The north province of U is very mountainous, and some of the cliffs looking down upon the valleys show a very fine example of columnar basalt formation. The interior of the island is an almost impenetrable wilderness of densely wooded mountains and sierras, seamed with deep valleys, clefts, and ravines. The heavy annual rainfall sends down numerous torrents from the slopes of the mountains which form the central watershed. A belt of swamp, covered by thick clumps of mangroves and other salt-water brush, surrounds the island. The mangrove belt at the mouth of the rivers is traversed by a network of shallow *tau*, or waterways, barely wide enough to allow a single canoe to pass. The scenery a little way up the streams is rich in beauty. The mangroves once pierced, one passes into a region of Nipa palm, tree-ferns, and tall trees interlacing overhead, hung with all manner of ferns, orchids, and creepers, the advance-guard of the hosts of the forest sweeping down upon the rich low levels. At a little higher elevation are found two varieties of the areca or betel-nut palm, which the Ponapeans, unlike the Malays and their Yap relations to the west, do not chew. Higher up still on the mountain slopes are found some valuable timber-trees. Amongst the mountains there are some well-grassed tablelands admirably suited for the pasture of cattle. In the mountains behind Ronkiti is a lake swarming with huge eels. Other lakes doubtless exist, but unfortunately very little is known about the interior, of penetrating which the natives appear to have a superstitious dread. On the hill-slopes grows a tall forest-tree bearing a reddish-brown rough-rinded nut about the size of a cricket-ball, valuable for the varnish yielded by its kernel. The Ponapeans call it "ais." It is the *atita* of the Solomon islands (*Parinarium*).

The most productive copra districts are Kiti and Chokach, and there is a considerable trade in fruit of the vegetable ivory, or rather sago-palm—the true vegetable ivory-palm being a native of South America.

The climate is hot and moist, tempered from October to May by the trade-wind blowing fresh and clear out of the north-east. The rainy season sets in about June, lasting to the end of September. This is the time of light variable winds, with frequent calms, and occasional heavy thunderstorms and south-westerly gales. According to Dr. Gulick's observations, the highest temperature marked in a period of three years was 31·7° Cent. (*i.e.* about 89° Fahr.), and the lowest 21° (about 70° Fahr.). The average temperature is 28·3° Cent. (= about 83° Fahr.). The annual rainfall is somewhat heavy. In the year 1890, observations taken on the *Maria Molina* hulk in Ascension bay gave 230 days in the year on which rain fell, and a total rainfall of some 36 inches.

The Ponapeans, like the rest of their Caroline neighbours, much resemble the Malays of the Philippines and the Sulu archipelago, the Dyaks of Borneo, and the wild hill-tribes of the island of Formosa. It is, however, natural, considering the various streams of population that have swept over the wide Caroline area, that the people of this region should exhibit quite a variety of racial types. Upon Ponape one finds a negrito type amongst the people on the bank of the Palang river, on the south-west coast. Amongst all the tribes of the island, I have seen individuals who, if a trifle lighter in colour, might pass for Samoans or Tahitians. The Polynesian element, however, is by no means the most powerful factor in the combination here, though in the Central Carolines, Ruk, and the Mortlocks it appears much more clearly. It is the sturdy Papuan or Melanesian element, derived from the lands of the south, which we find most strongly marked in Ponape. This influence is seen at work in the very language, wherein we see numerous unmistakable Polynesian words struggling for existence with all their vowel softness ruthlessly squeezed out and twisted into harsh and crabbed vocables. Here the rough and hairy

SCENERY NEAR THE MOUTH OF THE RONKITI RIVER, KITI DISTRICT, SOUTH-WEST COAST OF PONAPE.

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revengeful, and will bide his time patiently until his opportunity comes. Yet he is not implacable, and counts reconciliation a noble and princely thing. There is a form of etiquette to be observed on these occasions—a present (*katom*) is made, an apology offered, a piece of sugar-cane accepted by the aggrieved party, honour is satisfied, and the matter ends. The Ponapean is a stout warrior, a hardy and skilful navigator, fisherman, carpenter, and boat-builder, somewhat of an astronomer and herbalist, but a very second-class planter and gardener.

Their manner of life is simple and hardy. They go about in all weathers, rain or sunshine. The men's dress consists of a long thick native kilt or girdle of split coconut filaments (*kol*), the upper part of the body generally bare. The women used to wear a sort of deep petticoat (*likau*), woven of the fibres of a tree called *Nin*. Nowadays, greatly to the peril of their health, they have adopted European clothes. These they keep on their backs, whether wet or dry, which induces all manner of pulmonary ailments.

Their food consists generally of fish or shellfish, and a vegetable diet of yams, bananas, taro, and bread-fruit. The forests yield pigeons and some smaller birds very good for food. On the occasion of a feast, pigs and fowls are added to the bill of fare. The flesh of the dog (*kiti*) is highly relished, especially on the east coast. Crabs, crayfish, and fresh-water prawns, are also in request. The turtle is set apart for the chiefs alone. Eels, whether of the salt or fresh-water, they will not eat, and hold them in the greatest horror.

The special department of the women is the making of mats and shutters of reed-grass, the plaiting of baskets, and binding the leaves of the sago-palm into bundles for thatch. They make the leaf-girdles of the men, and compound the coconut-oil and fish-oil and the cosmetic of turmeric, without which no Ponapean dandy's toilet is complete. They fetch water in calabashes, light the fires, build the stone ovens, prepare the food, and perform all the household duties. When required, they cheerfully assist the men in their outdoor labours, and in time of war accompany their husbands and relations fearlessly into the battle.

The formality of marriage between young people is singular. The girl is brought into the house, and sits down whilst her future mother-in-law rubs coconut-oil vigorously into her back and shoulders. This is called *keieti*, or anointing. A garland of flowers is placed on her head, and the ceremony is concluded by a feast. The marriage bond may be severed at any time at the consent of either party. The Ponapeans for the most part content themselves with a single wife, polygamy being the privilege only of the wealthy and powerful chiefs.

Adoption of children is universal, and forms a complicated chain of relationships. Descent is traced through the mother—a custom tolerably common amongst the Oceanic races in general. Members of the same *tipu*, or clan, cannot marry; a wife must be taken from one of the other divisions. The suitor serves for his wife in the house of his father-in-law elect as Jacob did with Laban, and frequently has his pains for nothing. Men and women alike practise tattooing (*inting*) on the arms and lower limbs. Unlike the Marquesan islanders, they do not tattoo their faces. The women use a design taken from the interlacing of coconut fronds in their leaf baskets. Other designs are circles and eight-pointed stars and crosses. The young men, to show their contempt for pain, are in the habit of inflicting knife-gashes and burning deep scars on their breasts and arms.

They bury their dead with great ceremony and solemn funeral operations. They are most unwilling to repeat the name of a dead ancestor—a very Melanesian trait. Consequently we find in Ponape no elaborate family genealogies, like the ancient and carefully preserved oral records of the Marquesans and Maoris and the kindred Polynesian races.

Other interesting usages I pass over in brief: The *Charaui*, or Tabu, a series of solemn prohibitions defending life and property and enjoining the due performance of numerous religious observances; the *Chapu*, or definition of rights, ownership, and privileges of a chief; the elaborate ceremonies at their kava-drinking festivals held in their great *Nach*, or council lodges; their singular divisions into *Tai*, or brotherhoods, which form such a strong factor in their political union; the *Lekelek*, a terrible ethnic mutilation inflicted on their youth on reaching puberty, an ordeal which all must undergo; the *Ichipal*, or exchange of wives amongst friends, cousins, and brothers.

Their method of making war was as odd as the rest. Solemn notice was given, naming the day and appointing the place of battle. The beaten party were not pursued far, nor pressed to extermination. Prisoners were frequently spared, but sometimes were solemnly offered up in sacrifice to the tribal war-god. Little damage was done to the plantations and fruit-bearing trees under this system—remarkably mild for a people who hold human life so cheap.

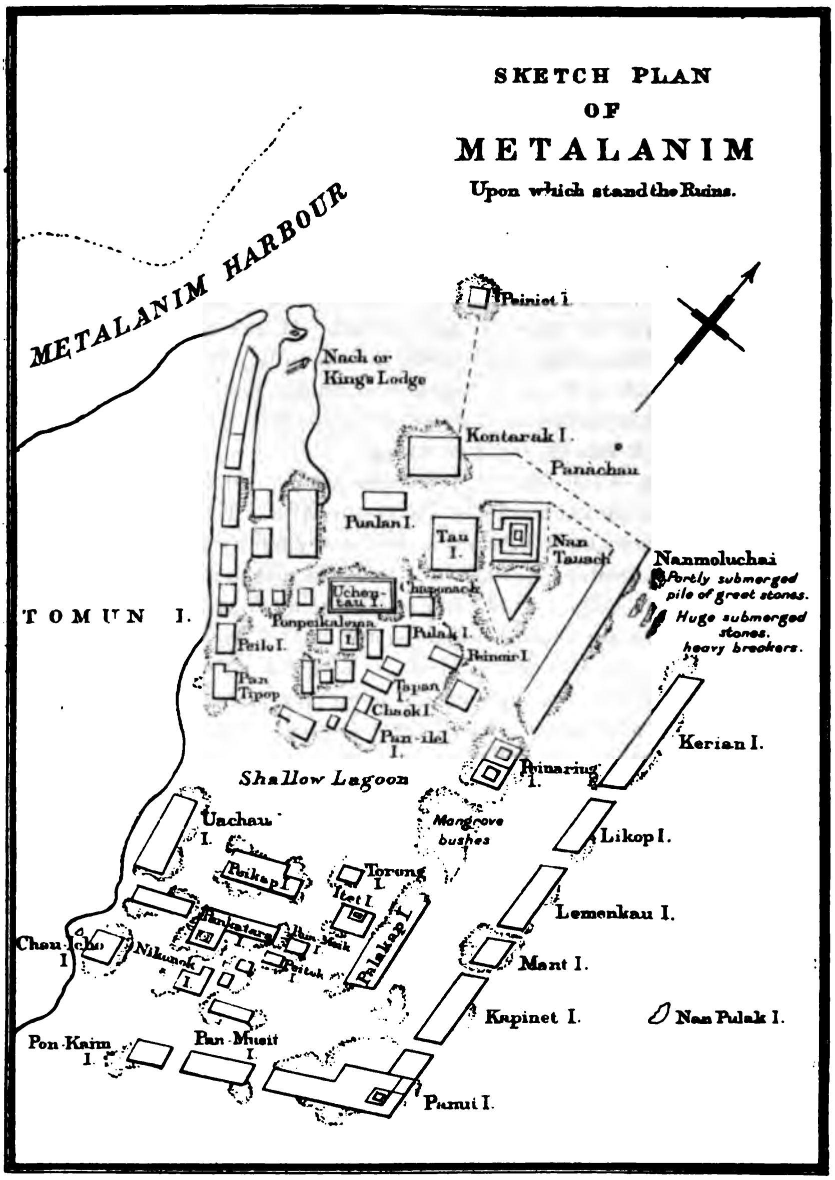
The tribes of U and Metalanim are governed by their Ichipau, or titular kings; those of Kiti by their nanamareki, or rajah; and those of Chokach by a wachai, or prince. After the chief ruler come twelve orders of chiefs, Chaulik being the smallest title of all, and after these the *Aramach-mal*, or common folk, and the *Litu*, or slave-class. Counted equal to the nobles were the two religious bodies, the *Chaumaro*, or high priests, and the *Laiap*, or priests of the second order. The head of the Chaumaro in each tribe was called *Na Uaim* (*Nan-Laim*). These were of great weight and importance in the land, and united the functions of doctor, magician, rain-maker, and diviner. Theirs was the knowledge of medicinal herbs and poisons, the gift of prophecy and of second sight, the interpretation of dreams and omens, and the dreaded power of *Ka-ria*, or imprecation of curses. Upon them devolved the ordering of court ceremonies and public festivals, and the seasonable invocation of the gods of rain and harvest, the staving off of famine and all calamities public and private, the maintenance of the Charaui, or Tabu. Theirs were the principal seats upon the Lempantam, or high stone platform in the Nach, or council lodge; theirs, next to the king's, the best portion of cooked food and Kara upon the days of solemn festival. Throughout all the tribes great respect was paid to the chiefs. As in Malaysia and Polynesia, there were many special words used in addressing a chief, and again there was another set form of words for addressing the king, who was looked up to with great awe, and only addressed in the plural of majesty as *They*. The chiefs mingle amongst their tribesmen with great familiarity and affability. They all hold together loyally—offend one, and all are eager to take up his quarrel. If the chief be a kindly hospitable man, his people will follow his example. If he be a rogue and a churl, his people will act as rogues and churls too. The people seem to have little independence of judgment, and love to follow the lead of their chiefs in all things, right or wrong.

The worship of the *Ani*, or deified ancestors, coupled with a sort of totemism, is the backbone of the Ponapean faith. Every village, every valley, hill, or stream, has its *genius loci*, every family its household god, every clan its presiding spirit, every tribe its tutelary deity. Thunder, lightning, rain, storm, wind, fishing, planting, war, festival, harvest, famine, birth, disease, death,—all these events and phenomena have their supernatural patron or master-spirit. The gloomy fancy of the Ponapean peoples the swamp, the reef, the mountain, and the hanging woods of the inland wilderness with hosts of spirits, some beneficent, the greater part malignant. All these *Ani* are honoured under the guise of some special bird, fish, or tree in which they are supposed to reside, and with which they are identified. Thus the chestnut tree is the medium of the god of thunder, the blue starfish of the god of rain, the shark of the god of war, etc.

In their mythology they have a submarine paradise. They also have a subterranean Tartarus of mire, cold, and darkness, guarded by two grim female forms, one holding a glittering sword, the other a blazing torch.

I will now give a description of our visits to Metalanim, on the east coast, and the result of our explorations amongst the famous ruins of Nan-Matal.

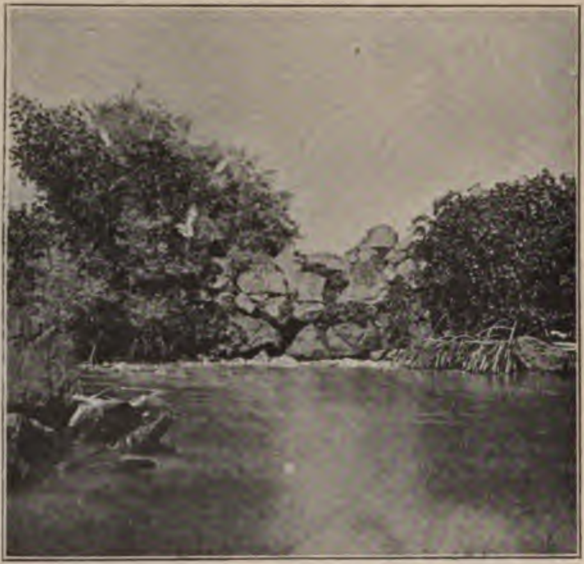
On the map of Ponape you will see a dense group of islets in the lagoon between reef and shore on the east coast, a little way down to the south of Metalanim harbour, and close under the islet of Tomun. They are between fifty and sixty in number. These numerous rectangular islets are mainly artificial in formation, built up out of the shallow waters of the lagoon. We found them enveloped in mangrove clumps, and shrouded in a dense mass of jungle and creeper. Two of them, Nan-Tauach and Pankatara, are encased in walls built of columnar basalt



shafts and prisms; others, like Uchentau and Itet, solidly faced with the same primitive material. A network of shallow canals intersected this island labyrinth, for the most part not holding more water than is required to float a canoe. The natives call the place Nan-Matal, or the place of the Matal or waterways. The tribal district off the coast of which this remarkable group of islets lies is called Metalanim, or "waterways between the houses." A massive breakwater runs along the edge of the deep sea, shutting in this picturesque mass of woods and waters. Against this rocky outer barrier break heavy rollers. Even in calm weather the swell makes landing here very dangerous, as we found out to our cost when we attempted to land at Nan-Moluchai, close to which is the inner harbour, of which two views of Kubary's give an excellent idea. Out to sea lie the islands of Na and Nakap, where there are scattered remains of another ancient sea-wall. From Nakap one can see the massive walls of the breakwater stretching down southward for 3 miles, the masonry showing out here and there through the dense tangle of shrubs and mangroves which crown and encircle the islets forming the great outer breakwater.

THE INNER HARBOUR AT NAN-MOLUCHAI.
(*From a photograph of Dr. J. S. Kubary's.*)

The area occupied by the islets of Nan-Matal is about 9 square miles. For the most part they are deserted, and altogether there are not above twenty people living on the three or four inhabited ones. Some of them are planted with coconuts and bread-fruit, and are visited occasionally by fishing-parties. The King's island of Tomun and the shores of Metalanim harbour are fairly thickly populated, but the folk as a rule give Nan-Matal a pretty wide berth. They say the place is haunted, and on certain of the islets, such as Pan-Katara and Pei-Kap, nothing will induce them to set foot. All the enormous quantity of basalt which the ancient builders used must have been brought in canoes or rafted down the coast, a distance of 20 to 30 miles. These pillars and blocks were carried down to the sea from the dales below the precipices of U and the great perpendicular scarp of Chokach, where the columnar basalt formation is very strikingly marked. Here were grand natural quarries, whence the builders might select all the shafts and pillars required, lying around ready shaped to their hand. We can still follow the course of the canoes or rafts which brought these great masses down. All around Ponape the bottom of the lagoon is strewn with blocks of basalt, which may have fallen from the canoes on their way. The natives account for their presence by saying that they are the bits of basalt used as sinkers for their nets, which grow large when they fall off and remain long in the water.

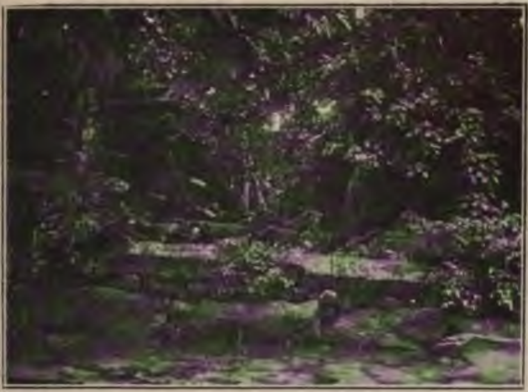


THE BREAKWATER AT NAN-MOLUCHAI: ENTRANCE TO THE INNER HARBOUR.

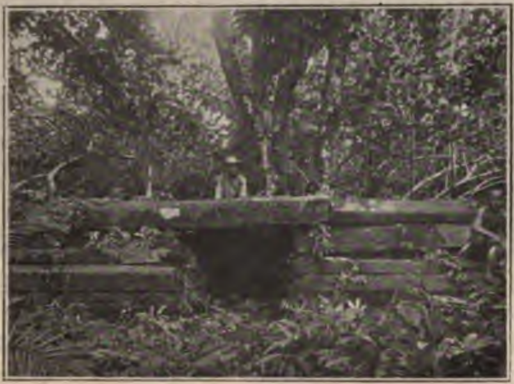
(From a photograph of Dr. J. S. Kubary's.)

We made three visits to the ruins, choosing the island of Uchentau for our camping-ground, where we remained in all about ten days.

The first of the islets we visited from Uchentau was Nan-Tauach, the most remarkable of all the Metalanim ruins. The water-front is faced with a solid terrace of massive stonework, about 6 feet wide, standing over 6 feet above the shallow waterway. Above is a striking example of immensely solid Cyclopean masonry. A great wall, between 20 and 30 feet high, and about 10 feet in thickness, formed of basaltic prisms laid alternately lengthwise and crosswise, encloses an oblong space, which can be entered only by the great gateway in the middle of the west face, and by a small portal in the north-west corner. The right side of the gateway is overshadowed and all but hidden from view by the dense leafage of a huge Ikoik tree. This we had not the heart to destroy, a wonder of deep green heart-shaped leaves, thickly studded with tassels of scarlet trumpet-shaped flowers. In olden times the walls must have been considerably greater in height, but much of the masonry has now fallen into lamentable ruin. A series of huge rude steps brings us into a spacious courtyard, strewn with fragments of fallen pillars. This encircles a second terraced enclosure



PRINCIPAL ENTRANCE ON THE WEST SIDE OF THE SANCTUARY OF NAN-TAUACH, THE MOST REMARKABLE OF THE WALLED ISLETS OF NAN-MATAL.



CENTRAL AND PRINCIPAL VAULT OR TREASURE-CHAMBER, CALLED THE TOMB OF KING CHAU-TE-LEUR, OR CHAU-TE-REUL.

topped by a remarkable projecting frieze or cornice of stonework. The outer enclosures we ascertained to be 185 by 115 feet, the wall varying in height from 20 to nearly 40 feet; the inner, which forms a second conforming parallelogram, measuring 85 by 75 feet. Height of the wall, 15 to 18 feet; average thickness, 8 feet. Another rude flight of steps leads up to the great central vault or treasure chamber, said to be the grave of an ancient monarch, who bore the dynastic title of Chau-te-Leur. It was difficult to gain much information about the old traditions at first. The natives certainly know something about the history of these ruins, but do not care to talk of them to strangers. This reticence I had to patiently overcome little by little, and consequently bit by bit a tolerably explicit little chapter of history was built up.

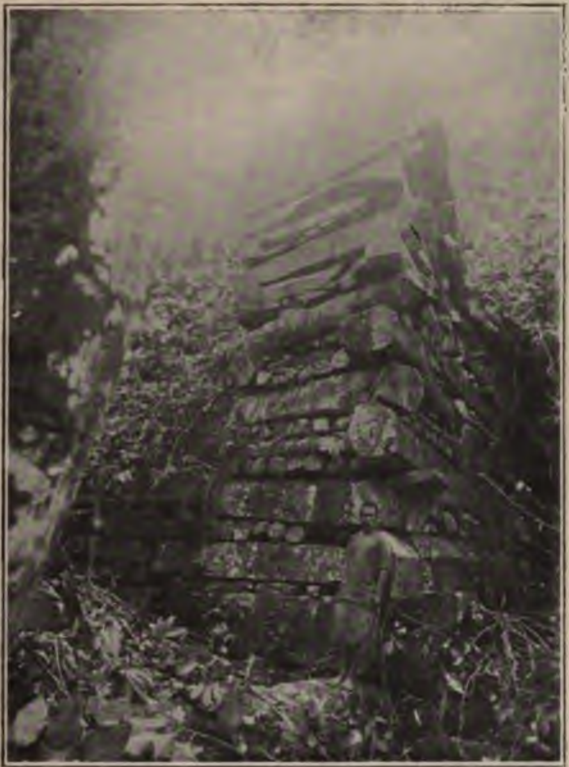
It appears that in olden days Ponape was much more populous than at present. All the tribes in the days of the builders were united under a powerful line of kings. The last of this dynasty met his death facing a great invasion of barbarians from Pati-Air, the barren lands of the south, probably some portion of New Guinea, the New Hebrides, or some neighbouring portion of Melanesian area. They arrived in a great fleet of canoes under the command of a fierce and terrible warrior, Icho-Kalakal. The savage invaders poured in upon the peaceful settlers, and blotted out the ancient civilization, after a great battle, in which numbers were slain on both sides. Part of the walls were thrown down, and the defenders either slain in battle or offered up in solemn sacrifice to the war-gods of their conquerors. King Chau-te-Leur himself, in his flight, perished in the waters of the Chapalap river, at the head of Metalanim harbour. The Ani changed him into a blue river-fish, which the folk of Metalanim to this day will not eat.

Now, the underground chamber or vault which bears King Chau-te-Leur's name lies right in the centre of the inner precinct, facing the great gateway. It is about 8 feet in depth, roofed in with six enormous slabs of basalt. The flooring was paved by some heavy basalt blocks, which we had great trouble in lifting away. Below this was a layer of soft vegetable mould, thickly matted with a tough root-growth that made excavation somewhat troublesome. The side nearest the entrance threatens soon to fall into ruins, and we had to pursue our digging operations very cautiously in this corner, for fear of being crushed by the collapsing of these mighty masses of masonry.

There are three other tombs or vaults besides the large central one, situated on the south-west, east, and north-west sides respectively. They are smaller in size, and gave up rather scanty results to our excavations. The one on the east side is very narrow, and some 12 feet in depth. Paul, the king of the Metalanim tribe, sometimes uses them as dungeons to confine those who offend him—a punishment greatly dreaded by the natives, in their child-like horror of the dark, and of the viewless spirit forms with which their fancy peoples these lonesome places.

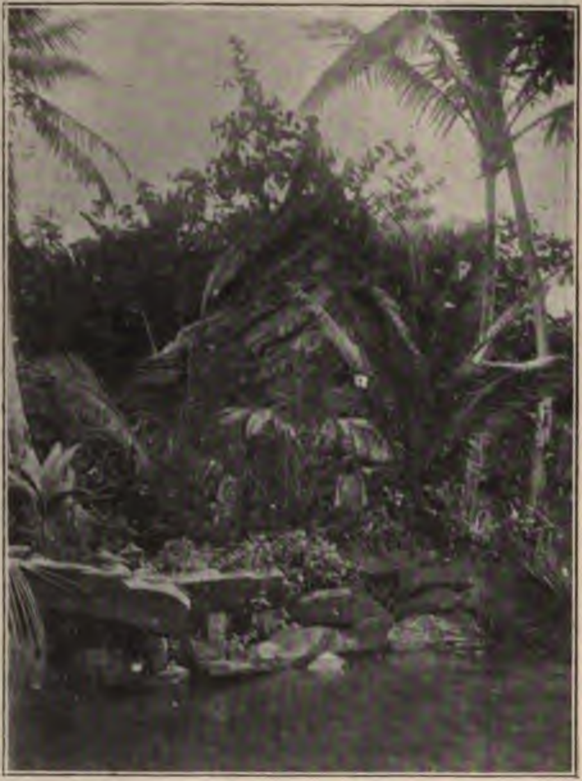
"The eyes of the spirits are watching everything you do," said Keroun, one of my workmen, as he tendered me his resignation. "I *know* they are angry; they will not injure you because you are a white man, but they will punish us. I am very much afraid; I cannot sleep at night, and I would like to go home."

Standing on the south-west angle, where the wall is nearly 40 feet in height, one looks down upon a green abyss of nodding woodland, with never a glimpse of the network of canals rippling below. The north-east angle is occupied by an enormous banyan tree towering full 50 feet above the masonry in which it stands firm-rooted, thrusting its bunches of thread-like root-fibre into every crevice. These as they swell exercise a constant and gradually increasing force, wrenching the blocks out of place. When a high wind blows the structure is racked through and through in every joint and keystone. Sooner or later, if nothing is done to remove the tree, this side of the wall will settle down into ruins. A tangle of weeds, grasses, India shrubs, and creepers thickly carpets the precinct. Clearing it gave us no end of work.



SOUTH-WEST ANGLE OF OUTER WALL OF NAN-TAUACH; HIGHEST POINT.

Beyond the two small cross-walls on the inner side of the great outer wall on the south-west side is a remarkable slab, inclining to a crescent shape, balanced on two solid shafts projecting out from the masonry. This, when tapped, gives a clear ringing sound, and was probably used for an alarum or for a sort of bell in sacred ceremonies. The north-west angle, as we come out upon the canal boundary on the west side, gives a happy impression of the style of architecture, the two walls at their junction running up high and bluff like the bows of a Japanese junk. Beneath, the terrace fronting the waterway is overgrown by a belt of young coco-palms of recent growth.



NORTH-WEST ANGLE OF OUTER WALL OF NAN-TAUACH.

News of our excavations, and of the havoc we were making in the jungle in our clearing operations, finally reached the ears of King Paul, who at once put a stop to our work. Most unfortunately, his superstitious terrors were confirmed by a very severe epidemic of influenza that broke out in the tribe shortly after our departure, and carried off many of the Metalanim people.

The result of our excavations in the central vault was distinctly encouraging, and it is a great pity more time could not have been spent at it. To thoroughly explore and clear the labyrinth of this Micronesian Venice and to make thorough excavations would take several months' hard work. It is very difficult to get the natives to work here, owing to their dread of the vengeance of the ancestral spirits and heroes hovering around these holy places, ready to let loose some terrible judgment upon the head of rash intruders. Another great drawback to exploration likely to continue during the reign of King Paul is a deep-seated hostility to the white man felt by many of the Metalanim tribesmen. When a more enlightened chief succeeds him, future explorers will have a better chance.

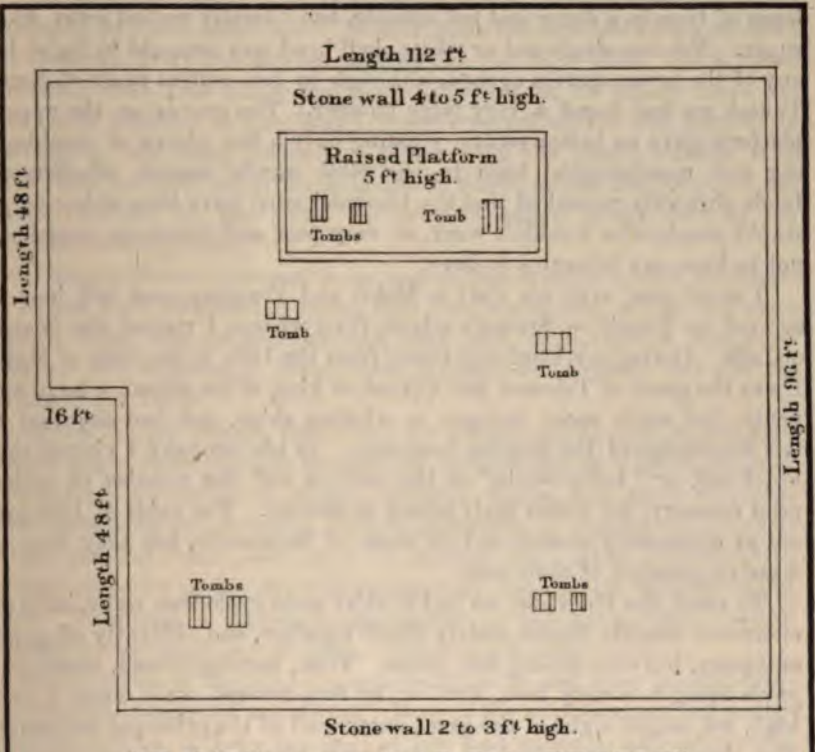
The list of our finds included eighty shanks of fish-hooks of pearl-shell in a more or less perfect condition, possibly broken on purpose by the clansmen on the burial of their renowned chief. Close by Metalanim harbour is a district called Matup, still renowned for its manufacture of shell bracelets. We found five of these carved shell rings of elegant design, and twenty or thirty plain ones. Most of them were far too small to go round the wrist or arm, and probably were strung into necklaces with the edges overlapping, like the neck ornaments of the Melanesian area.

We found a great number of pink round shells and pendants of rectangular shape, which, when strung in rows upon a framework of fine cinnet thread and banana fibre, formed the *Tor*, or chief's belts, which in Ponape to this day are so valuable an heirloom. Some of the beads were nearly as large as a halfpenny, most about the size of a shilling; the smallest were very minute in design, only about a line in diameter. Our great prizes, however, were ten or twelve ancient axes, three of them about a yard in length, rubbed down from the central shaft of the *Tridacna gigas*, or giant clam. Some of the smaller ones were of fine workmanship, white and strong as polished marble, with keen cutting edges. Others, again, had suffered greatly from erosion from their burial through untold generations. I have since seen two shell axes very similar in design, but much smaller, in the collection of the Rev. R. H. Codrington, who obtained them from the Banks islands.

The names of some of these embanked islands are interesting. *Nan-Tauach* means the "Place of Loftiness" or the "High Walls." *Nan-Moluchai* may be taken to mean "the Place of Cinder-heaps," left from the cooking fires of the host of workmen who assisted the demigods Olo chipa and Olo-chopa in the construction of the mighty breakwater and walled islets which occupy the space within. *Pei-Kap* means the "New Pavement." On the east side of Pei-Kap is the turtle-stone of Icho-Kalakal, upon which men say the captives of war were sacrificed to Icho-Lampoi, the god of war. *Lamenkau* means "Deep blue water off the edge"—a highly appropriate name for its station on the breakwater. There is a Lamenkau also in the Banks islands. *Pan-Ilel* means the place where you have to steer, so called from the intricate mass of shallows around it, choked up with water-weed, man-groves, and salt-water brush. Near Pan-Ilel a huge block of basalt lies under the masonry at the canal side, called the shield of Chau-te-Leur.

The name of the haunted island of Pan-Katara means the Place of Proclamation or the Sending forth of Messengers. This precinct, tradition declares, was anciently the seat of government, where the king and nobles held solemn session and festival. The isle is greatly dreaded by the natives, who say that the curse of leprosy will smite any one who sets foot in the place. The height of the wall which surrounds this island is 27 feet. The solitary inhabitant is a white goat, who, tired of the society of ghosts and shadows, came down to meet us, bleating his welcome at the sight of honest flesh and blood.

After leaving Lot we went down to visit Joe Kehoe at Nantamarui, close to the Kiti border, where we stayed several days. On hearing from our kind old host of some curious ruins on a hillside in the back country, I determined to explore them. Accordingly one fine morning Joe Kehoe, his eldest son Louis, and myself are trudging up the hill-ridge behind Nantamarui over a rough, steep, and intricate trail—I will not call it pathway—thickly carpeted with convolvulus, which treacherously hid from our view the numerous slippery boulders and fragments of shivered basalt. By-and-by the labyrinth became worse than ever, and for several hundred yards we had to fight our way on, hewing right and left with our 18-inch knives, climbing over fallen trunks of great forest trees, and ducking under low natural archways of hibiscus. As by degrees we worked our way nearer to the region of tall forest trees, the underwood became less dense. Finally, passing one of the buttressed kings of the forest, we suddenly came upon a low breastwork of stones enclosing the object of our search, which turned out to be a cemetery in the shape of an irregular or broken parallelogram, as can be seen from the sketch-plan. Six graves were found in the lower enclosure, and three on a platform raised five feet above the level of the ground. All were little vaults not exceeding 4 or 4½ feet in length within—roofed in with massive slabs of basalt, the graves of the fairy folk, little woodland elves, answering to our own pucks and pixies. Ethnologists would style them dwarf negritos, like the Aetas of the Philippines and the Jakou of New Guinea. These Chokalai, according to Ponapean tradition, were the little dwarfish folk who dwelt in the land before the coming of "Kona" and the "Liot," the giants and the cannibals. The two latter terms, as I have already said, probably represent respectively the Malayo Polynesian settlers and the savage Melanesians from the south. The speech of the dwarfs, it is said, was a chattering and a gibber as that of bats; they were dark of skin, and flat-nosed. They are believed still to haunt the dark recesses of the forest, and are very malignant and revengeful. I was told that one man who came to this haunted dell to plant kava, was caught up and spirited away by the revengeful goblins, and his lifeless body was found many days afterwards, stretched upon a great flat rock by the seashore off Nantiati point. A curious fact concerning this primitive race was supplied me by the Au of Marau shortly before leaving Ponape. The people at the mouth of the Palang river, near the Chokach and Kiti border, are said to have been descended from the *Chokalai*, who, it seems, were not everywhere exterminated by the Malayo Polynesian conquerors. The Au's description runs thus: "In the speech of the Palang folk is a most foolish undercurrent of chatter; they are shorter in stature and their skins darker than their neighbours'; their noses are flat, and they are known throughout the tribes as the *Paikop-faces*. Now, the Paikop is the most ill-favoured of fishes, with wide goggle-eyes and a face as flat as a dish." Unluckily, I had no opportunity of visiting the Palang folk, though they are said to be thieving and treacherous. There seems



GRAVES OF THE "LITTLE PEOPLE".

no reason why the tale of the Au should not be true, and that we have here, overlapped and all but exterminated, the survivors of the Negrito race who made these curious little graves.

After clearing away the luxuriant undergrowth, we cautiously removed the basalt slabs at the top of each little vault, and found in the red soil within an abundant deposit of blue mould, promising good results. In the first few minutes a very minute shell adze-head was turned up, and a stone knife. No other results rewarded our efforts, save a few pieces of mouldering bones. All the rest, with the great lapse of time in a damp and hot climate, has literally melted away like sugar. Not one single red or white shell-bead was brought to light in any of the seven graves opened, although in the central vault of Nan-Tauach we had found a very large number. The graves on the upper platform gave no better return, yielding only a few pieces of mouldering and unsubstantial bone to our most careful search, whereupon Louis shrewdly remarked that the Chokalai must have been either very stupid people who wouldn't work, or very poor and barbarous wretches, not to have any treasures to bury.

I must pass over my visit to Mokil and Pingelap, and tell how I arrived at Kusaie or Strong's island, from whence I visited the island of Lele. During my brief stay there, from the 10th to the 15th of May, I was the guest of Teleusar the Tokosá, or king of the island, who in his youth had made many voyages in whaling ships, and had acquired a fair knowledge of the English language. In his company I visited the Pot-Falat, or "Lofty walls," as the natives call the remains of cyclopean masonry, for which their island is famous. The ruins of Lele are not so elaborately constructed as those of Metalanim, but they have a massive grandeur of their own.

To reach the Pot-Falat we had to skirt some cyclopean walls, built of enormous basaltic blocks, rudely fitted together, and evidently of great antiquity, but now falling into ruins. Then, turning inland, about 300 yards along a muddy lane, shut in by fern-covered walls some 5 feet high, we caught sight of the great outer wall of the principal enclosure. The masonry is composed of rude basalt blocks and prisms, many of them enormous in bulk, but clumsy in disposal. Looking at their solid outlines, seamed and furrowed by the rain and sun of untold generations, one cannot help marvelling at the ingenuity and skill displayed by these primitive engineers in lifting, moving, and setting down such huge and unwieldy masses of stonework.

The sides of the enclosure of the Pot-Falat measure 194 feet by 110 feet. On the east side the wall has been much destroyed, and is now a rough mass of broken basalt varying from 8 to 15 feet in height, overgrown by a wild tangle of hibiscus and other brushwood, ferns, and creepers. At the south-east angle the wall rises to a height of 30 feet, and the masonry is very massive, one of the blocks measuring 10 feet by

8 feet and 2 feet 6 inches, and embedded one above the other in the foot of the wall are three roundish masses of basalt, the lowest measuring 6 feet by 4 feet by 3 feet. At the south-west angle the stonework is 20 feet high. In the west wall are two openings—the first 7 feet and the second 15 feet wide. There are also two openings on the north side. The walls were probably about 10 feet in width; but, owing to their ruined condition, it is not now easy to determine if they were originally of the same breadth throughout.

Outside the north and east walls there runs a shallow canal, bordered by a low stone wall. Rough stone barriers have been recently built across it by the natives to keep out the high tides; but it seems probable that this canal, and the many others, of which there are abundant remains on the island, were constructed for the purpose of rafting up the huge blocks and pillars from the beach, whither they had been brought from South harbour, where nature has indulged her spoilt children by providing the massive shafts ready cast in her furnaces underground.

There is little of interest to be seen in the interior of the enclosure. A ruined wall divides the space into two courtyards, which are overgrown with coco-palms, banyans, and jack fruit, and a tangle of creepers and underwood, conspicuous amongst which stand out the red spikes of the Ixora.

Much to my regret, there was no time to make any excavations which might have brought to light, as in the ruins of Metalanim, some interesting specimens of native weapons, beads, and shell bracelets. Any future visitor, however, who is ambitious of making excavations inside the Pot-Falat need have no anxiety that King Teleusar will behave as badly as his brother monarch of Ponape, the churlish King Paul. Doubtless, a thorough exploration of the little island lasting several weeks would reveal many curious relics of the past.

The interior of the island is somewhat hilly, and very thickly overgrown with brushwood and forest. Most of the south-eastern and south-western portion of Lele is a tract of low land patiently and laboriously reclaimed in olden time from the sea. A network of canals, very much out of repair, intersects this reclaimed land, many of them partially filled or banked up by the natives in modern times to keep the tides from turning their taro patches and cleared lands into a salt swamp. The remains of immensely solid walls in the neighbourhood of the king's house and along the beach, are no doubt, like the Pot-Falat, relics of an elaborate system of fortification, the product of large numbers of native workmen toiling under the orders of an intelligent minority belonging to a superior race who had a practical knowledge of engineering. As said before, the natives have a dim tradition of foreigners coming in strange vessels out of the north, who settled on Lele and put the chiefs of Ualan—the main island—across the bay to tribute.

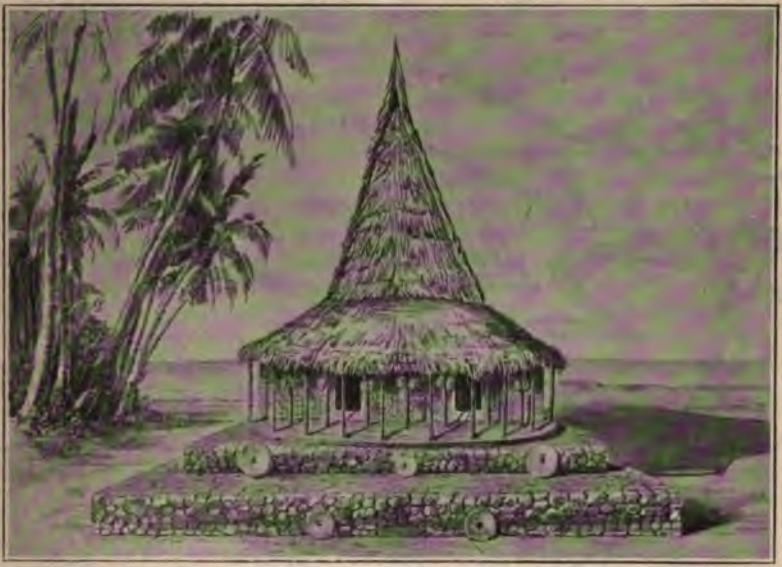
The natives do not appear to consider that any special sanctity or awe attaches to these structures. Though possibly the work of a kindred race, the ruins of Lele are far rougher and ruder in design than those of the east coast of Ponape. If so, it may be contended that on Ponape, a much larger island, there were more workmen and better material, which consequently gave a superior result.

Like the Ponapeans, the people of Lele used extensively axes and adzes (*tola*) of excellent workmanship, laboriously ground and polished down from the great central piece of the *Tridacna gigas*, or Popol shell. The specimens obtained from Li-kiak-sa, the venerable native teacher of Lele, are excellently white, and smooth as polished marble, with fine cutting edges. In length they measure from 6 to 9 or 10 inches, by 2 or 2½ inches in breadth. From the pendanus leaf the natives make hats, ornamental baskets of pretty design, and light delicate sleeping-mats of fine texture. But the most interesting industry of all is their weaving of fine belts and ribbons from the soft and delicate fibre of the banana. The Banks islanders have a similar machine, and produce a similar fabric with a chevron ornamentation. The people of Bencolen, in Sumatra, use the same kind of loom, which they called *Pisa*. In manufacturing it they use a loom or primitive weaving machine (*puas*), very similar in model to that seen in some of the villages in the interior of Japan, where the restive demon of machinery has not yet wholly ousted hand-manufactures. The patterns are quaint and graceful, and the grouping of the tints carefully considered and worked out. Harsh, crude, conflicting colours are strictly set aside. A rich blue tint is obtained from the juice of the young banana suckers, the wild turmeric root supplies the shades of yellow, black tints are obtained from burnt nuts of the Aleurites, and a rich reddish-brown is prepared from the scraped and pounded bark of the mangrove.

I will now ask you to follow me to Yap, where I arrived in October, 1896. The Yap group consists of one main island and a number of smaller isles. The main island is composed of volcanic rock and of coral limestone. Towards the north it is nearly cut in two at the isthmus of Girigir. In the north and central part of the island there is a range of hills of slight elevation which does not exceed 1000 feet, whose slopes distribute the rainwater to the lowlying districts. When any considerable time passes without rain, the water runs short. The population amounts to some 8000. The folk apparently belong to the Malay race, with a slight mixture of Polynesian. They are not particularly cordial to strangers, but when once accustomed to their presence they are inclined to be hospitable. They are revengeful when they conceive that their honour is insulted, and they often fail to keep their word. On the whole they may be said to be peaceful and apathetic. They are fond of fishing, and their robustness of body and docile nature make them well adapted for all sorts of labour, though in general they are lazy. Socially they are divided into four classes—nobles, magicians, rich men, and slaves. Their houses are solidly built of bread-fruit and callophyllum wood, artistic in form, thatched with nipa palm and pandanus leaf. The walls are of light canes bound in rows with a cording of cinnet or coconut fibre.

Yap does not produce many timber-trees. The island is surrounded by a belt of coconut palms about half a mile in thickness. No cereal is under cultivation. Maize would probably yield well, but I never saw any, and the Spanish told me that they had not tried it.

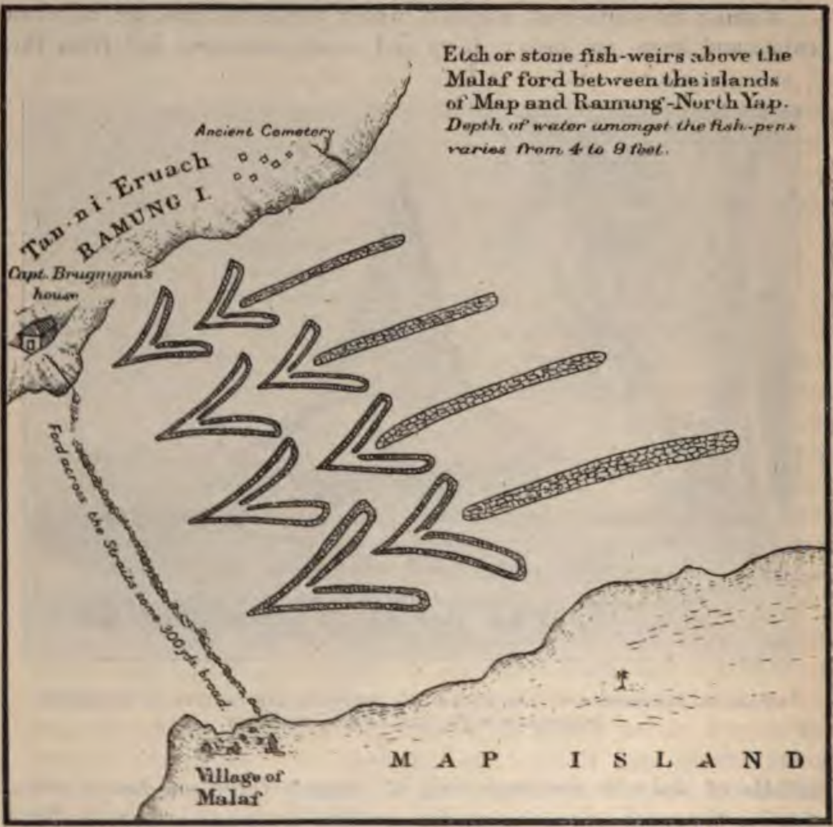
During the south-west monsoon, which begins in June, the days are calm, and there are heavy dews and much moisture, and from the middle of July to the beginning of August there are heavy rains. During the north-east monsoon the weather is dry and there is little dew. Typhoons are not uncommon between August and December. The temperature varies from about 74° to 80° Fahr.



FE-BAI OR CLUB-HOUSE AT LAI, SOUTH YAP, SHOWING THE CALCITE OR LIMESTONE DISCS CALLED FE, THE NATIVE CURRENCY.

Before describing the architecture of the club-houses and the ancient tombs, I must call attention to the peculiar coinage or medium of exchange in Yap. First and foremost comes the stone money, which consists of quartzen wheels, varying from 6 to 8 inches to 12 feet in diameter, which form a most unwieldy medium of exchange. A man who had extensive business debts to meet or cash payments to make would need some ten yoke of bullocks and a waggon to transport his specie. Generally speaking, however, these stones are more for show and ornament than for use. The village club-houses are called *Fe-bai*, or stone money houses, from the wheels of stone which rest against their walls. In any of the settlements these great discs or wheels may be seen leant up against the walls or terraces of the houses of the *Madangadang*, or plutocrat class, which here, as elsewhere, enjoys considerable distinction in the national councils.

A perfect pair of large shells, the valves of the pearl oyster, are also highly valued and used as money. The natives call them *Yar-ni-Balao*, *i.e.* Pelew island shells; the early Yap navigators used to make extensive forays on the pearl-shell beds of their long-suffering neighbours of the Pelew group, and were often forced to defend their ill-gotten treasure in many obstinate battles by land and sea. The smaller specimen of pearl-shell threaded upon strings of hibiscus fibre or cinnet, about twenty on a line, used to be employed as small change. In these days, however, bags of copra or dried coconut kernel are employed as


Etch or stone fish-weirs above the Malaf ford between the islands of Map and Ramung-North Yap.
Depth of water amongst the fish-pens varies from 4 to 9 feet.

a medium of exchange. It may be observed that in the northern islands of Map and Ramung, and the wilder parts of the main island, the money of the white man, whether English, Spanish, or American, is hardly ever accepted as legal tender, and it is only in the settlements around the Spanish colony in Tomil bay the natives have learned to recognize its value.

There is yet another treasure highly prized in Yap, but which from its comparative rarity is seldom bartered. It is a coarse shaggy white mat, resembling nothing so much as goat or dog's skin; it is made from the beaten-out bark of the Kal or lemon-hibiscus tree. It is not for use, but merely for show, and is always kept religiously rolled up in a safe corner. It is exactly the counterpart of the *Ie-sina* of Samoa, a white shaggy mat made out of the fibres of the bark of a species of *Ramie*.

After the reading of the paper, the President said: When Admiral Bridge's paper on these islands was read here twelve years ago, we, to our great regret, had not the pleasure of seeing him, as he had just been appointed to the *Colossus*, and the paper was read by his paymaster, Mr. Matthew. Well, twelve years have elapsed, and now we have the great pleasure of welcoming Admiral Bridge back from his command in Australia, and I trust that he will make up for our great disappointment when his paper was read, by opening the discussion on Mr. Christian's most interesting paper this evening.

Admiral Cyprian Bridge: I am very much afraid that, when the audience hears the little I have to say, after the very admirable account given us by Mr. Christian, it will be disposed to think that the loss in not hearing me before was somewhat less than your President, in his courtesy, tried to convey. It is now over fifteen years since I visited the Caroline islands, accompanied by my friend Mr. Le Hunte, who is about to leave this country to take up the office of Lieutenant-Governor of New Guinea, in succession to that very distinguished public servant, Sir William MacGregor; Mr. Le Hunte accompanied me as Judicial Commissioner of the Western Pacific. We visited many other groups of islands during our cruise; but it was in the months of June, July, and August, 1883. Therefore, even if I had made myself so thoroughly acquainted with them as to be able to give you any long description, after the very admirable account to which we have just listened, I am afraid my account would be rather like last week's paper after this evening's special edition. With regard to the great buildings on the island of Ponape, Mr. Christian has not dealt at any length upon the immense amount of work that he must have carried out in order to see the ruins at all; because the luxuriant vegetation of these tropical islands has nearly covered all these ruins, and a not very observant visitor might go there, and never know there were such things. The photographs he has shown us this evening can only have been taken as a result of a vast amount of clearing away. His plans are probably the first approaching anything like completeness that have been made. There are earlier plans, as the ruins were first described by the eminent Polish naturalist, Mr. Kubary, whose acquaintance Mr. Le Hunte and I made at the Pelew islands, and whose decease I have heard of with regret. He was only able to investigate a portion of them; and if anybody is curious in the matter, he will find a detailed account of his exploration in a book in German, called an 'Essay on South Sea Curiosities,' by Steinlitz and Kreuse, published at Hamburg in 1881. The "Cemetery of the Little People" I fancy Mr. Christian is the discoverer of; as, though having visited Ponape, I never heard of it until this evening, and I can easily understand, from the Metalanim rocks which are close to the sea, the great difficulties he had to overcome before making the plans we saw just now. I am not sure that I understood Mr. Christian aright, but I fancy his opinion is that the ancestors of the present natives were the builders of these great ruins. I should be very reluctant to appear to hold an opinion on such a subject contrary to any conclusion arrived at by Mr. Christian, but I confess it seems to me almost impossible. Not only are the buildings great artificial structures, but the very islands on which the buildings are made are artificial; and that vast area, I think about 3 miles square, of which Mr. Christian gave us a plan, is itself entirely artificial; so that this Micronesian Venice has had even less help from nature in the way of construction than the Venice in the south of Europe. The structures themselves are of great size, and the materials of which they are composed are of the most massive description. I think Kubary estimated that some blocks of stone must have weighed 7700 lbs.—over 3½ tons. As Mr. Christian told us, these hexagonal basaltic columns are quarried 30 miles away. Now, it is inconceivable to me, having seen the natives of Ponape, that they ever got these great masses from the quarry to the places where the structures are, much less build the structures. In the same way, in the island of Lele, the ruins are of a totally different character, built, not of basaltic prisms, but great irregular blocks of stone, some of very great size. The ruins differ essentially from those on Ponape; they are on the land, and the others are in the water. It seems incredible, no matter how much you allow for national degradation and forgetting the arts of their ancestors—no matter how much allowance you make, it seems to me incredible that any people of the present race should have constructed these immense works, of which we see the remnants. There is something to the white man very comforting in that belief. Wherever we go throughout the South Sea islands, we find the native populations diminishing. I believe I alluded to this in the paper to which your President referred just now. There were then two exceptions when I was at that time in the Pacific—Wallace Island, now under the French, and Savage Island, which lies to the east of the Tongas. I was at Savage island again three years ago, and I regret to say, having landed on the island, where they are all Christians, and many speak English fluently, I found that the population was diminishing; and I was told in Samoa, by the French Catholic missionaries, that the Wallace island people were diminishing also. It appears likely, then, that these great ruins were built by a race entirely passed away; which had not only diminished, but had disappeared long before any white man visited the islands; and it is comforting to think that the diminution and approaching disappearance of the present Pacific races is in no way attributable to us, but was probably going on long before we appeared on the scene. The builders of these immense places, like the mound-builders in the Mississippi valley, or Yucatan, and Central America, investigated by Mr. Maudslay, have disappeared quite independently of contact with any white people. I have only a few words to say about Yap, and these great stone coins or pieces of money, so well delineated in the photographs. They are made of stone not found in the island of Yap; it is found in the Pelew islands, 200 miles distant; and when my friend and I were in the Pelew island in 1883, the king of Korror allowed a hundred Yapmen, who were replaced from time to time, so that the number was always kept up to about a hundred, to live in his territory, to quarry these great discs of stone and send them over to their own island. At the present day they are carried across in schooners. We saw several 6 feet in diameter, and estimated the weight at over 3 tons; but we were told of one which was over 9 feet 4 inches in diameter, and estimated to weigh 4 or 5 tons. Now, it is quite mysterious how these things were conveyed across 200 miles of ocean before the white man's schooners had come. They do move them about in Yap, between canoes; quite a fleet of canoes is required for them. That would not do across the open ocean. But, as some of the stones are very old, it is certain they came over before the schooners arrived; how they can have been brought is another mystery of the Pacific. I am afraid that, considering how very little information I have conveyed, and how very little I have supplemented what has been so ably told us by Mr. Christian, I have occupied your time rather longer than I ought.

The PRESIDENT: We have the pleasure of welcoming here this evening the new Governor of New Guinea, and we hope that accounts of any exploration undertaken under his auspices will be sent home by him to us in correspondence. Mr. Le Hunte accompanied, as deputy commissioner, Admiral Bridge when he visited the Caroline islands in the *Espiegle*.

Mr. LE HUNTE: I was not prepared for this distinguished reception to-night; I am sure, after what we have heard from Mr. Christian and Admiral Bridge, I should only be repeating and taking up your time unnecessarily. It has recalled to me one of the most interesting and pleasant times I can remember, that cruise of five months through the Western and South Pacific, and especially our visit to Kusei and Ponape, in the Carolines. Nothing can really convey, not even the words of the lecturer or the photographs or Admiral Bridge's speech, their beauty, which was marvellous. The vegetation is most beautiful. I found a magnificent red "Ixora" in one court of the ruins. I don't know whether it existed when Mr. Christian visited the place, or whether it fell a victim to the necessities of making room for the camera—a scarlet waterfall of flowers. [Mr. CHRISTIAN: It is still there.] I can quite understand the difficulty he found in clearing the ruins, because it was really a work of some difficulty, if not danger, to explore them, for I know nothing so hard as to sit down suddenly on one of these basaltic columns, hidden by creepers, and covered with slippery moss, and you sit down pretty frequently. I have no pretension to understand or be able to discuss the scientific questions. I was accompanied in my rambles about the ruins by a humorous though somewhat silent native of New Caledonia, and we were both of us extremely puzzled as to the builders of this marvellous sea city; but my friend "Joe" solved the difficulty by turning on his heel and remarking, "Debble, he build um." I could not go any further. I am inclined to agree with Admiral Bridge, with deference to any better opinion, They could not have been built by any races we saw, or any linked to them as natural predecessors; they must have been, I think, a separate race altogether. One thing I noticed was that all the defences faced seawards, and not inland, which to some extent shows that they were built by residents, and not by people attacking the island from the sea. On our visit to Yap we saw the extraordinary collection of stone money, which is perhaps not the right word; it is a token rather than a medium of exchange. At great festivals they interchange them, not in the same way as barter, but in the same way as the Fijians will exchange whales' teeth; they represent a value we can put no estimate upon. As Admiral Bridge says, they come from the Pelew islands. We saw scores of these enormous millstones in front of the king's treasure house at Yap. This evening's lecture has brought back most vividly to me a most interesting visit to these islands. As your President has alluded to the work I am going to, I may say I look forward most heartily with interest and zest to seeing further mysteries, and taking a very humble part in their elucidation.

Mr. A. P. MAUDSLAY: After hearing three people who have been to the Caroline islands, I cannot add much to the discussion. I took part in the discussion on our previous paper, and then expressed a hope that some one would soon arise to give us an account of the ruins at Metalanim. We have had to wait fourteen years, and are proportionately thankful to Mr. Christian for what he has told us. I am glad to hear that Mr. Christian will very likely return, and as he has told us there are something like 11 square miles of ruins, there must be a great deal of work still to be done. Now, in one way I sympathize with him very much. When he went to the Carolines, he went principally with the idea of studying the languages, and not the ruins; and I have been placed in very much the same circumstances myself. When I first came across a ruin in Central America, I did not know what to do with it; it looked very big and very formidable, and I did not know how to set about recording my observations. Luckily for me, when I came home I fell into the hands of Mr. Coles, and anything I have since been able to do has been much owing to the instruction he gave me, and the advice I received from the officers of this Society. Now, we do very much want a still further exploration of Metalanim, and I trust Mr. Christian will put himself in Mr. Coles's hands, and bring us back in a year or two a very detailed plan of this town of 11 square miles. It is a big job, and it will take him, I am certain, more than one season. With regard to the ruins themselves, one speaks of masonry, but there appears to be no sign of tool-marks on the basaltic rocks; they are treated much as logs of wood, one piled up on top of another, and I believe the only implements Mr. Christian found are those very interesting shell axes. In those graves which Mr. Christian opened he found some bones in such a condition that they hardly seem to imply a very great age; however, one skull only is so far perfect that we may be able to get correct measurements; but if he will go back and again tackle the graves which still remain unopened, we may be able to get hold of some skulls that will tell us at least what people they were for whom these tombs were built; and that, I take it, is one of the most important works that lie before him. I can't say how much I envy him the chance of going back to Metalanim, and having another turn at those ruins. I am sure we shall encourage him to do it as soon as possible, and bring us back again as interesting results as we have now.

Mr. Hercules Reid: It is with considerable diffidence that I rise to say anything of this matter. Mr. Maudslay said he was diffident, but he at least has been in the Pacific; I can make no such boast. There is one point, I think, that is perfectly clear—that is, from the position of these islands, as you see on the map, there is every probability of the race being a mixed one, and from Mr. Christian's account it appears that the natives' opinion is that the earliest race was one of dwarfs or negritos; then followed a race of giants, after them came cannibals, and then I think the present inhabitants. That is as I understand Mr. Christian's account. Now this, I think, has many factors in common with the traditions that we find all over the world, not excepting our own country. We see evidences in the photographs that Mr. Christian has shown us, in the stories that he has told us, of the varying influences of these different races who at one time and another came from the west and the south, or possibly from the north. I think the nearest existing negritos are in the Philippines. The type of house that we see in the photographs, with the high-peaked ends, are precisely the same as are found in the south-east peninsula of New Guinea. Certainly I think those present who know the Melanesian type will agree with me that many of the types in the photographs are Melanesian. We have every possible type that could be expected in islands such as they are, and for that reason I am afraid, even if the skulls be brought here, we shall get only a confirmation of what would be possibly the case. Of course such a confirmation is very important, and it may confirm what we already guess; it may also give us some ideas we did not possess about those islanders. Now, there is one point that Mr. Christian has rather insisted upon, and that is the Japanese type of these megalithic structures. For my own part, I must confess I cannot see necessarily any Japanese influence at all. It is quite possible that the Japanese may have come down to these islands; it is historically certain that they did come down to the Philippines; but if you look at the map, that was simply a coasting voyage. If they had gone out to the Carolines they would have had a very different trip indeed, and before assuming such influence it would be well to find some further confirmation of it. These structures, which are, of course, the most interesting feature of these islands, may properly be called structures on the timber plan, very like log huts; as Mr. Maudslay said, there is no sign of tool-marks upon them. They are simply piling Pelion upon Ossa. In that they differ from some others found in the Pacific, notably in Tonga, where in one well-known instance, most frequently photographed, there is a kind of slot in the lower stone into which the upper stone fits. Now, that shows a considerable advance in culture over the piling of one stone upon another, just as trunks of trees would be piled. I think it is very improbable that, even if the Caroline islanders wished to work these stones, they had anything with which they could do so; of course, these fine shell axes are excellent for wood, but I think against these basaltic columns they would be quite ineffectual. Now as to the question who were the builders. I shall not detain you long. For my own part, I do not see any reason whatever why the present inhabitants of the Caroline islands should not be the descendants of the people that made these buildings. That, as you know, is contrary to the views of two-thirds of those present who have spoken on the subject; but I think the evidence that Admiral Bridge himself gave us is something toward a solution. He told us that these stone discs, of an enormous weight, were brought by somebody from the Pelew islands, and I think, if these things now have a common value to the existing islanders, the probability is very great that they were made by their ancestors, and if so they were brought from the Pelew islands by the same people. Now, if they could bring these enormous weights from this distance, surely they had engineering skill enough to put these stone columns one upon another. I may cite, in illustration of my hypothesis, the present inhabitants of Egypt; would anybody, without knowledge, suppose that they were capable of building the gigantic and artistic structures to be found there? I don't think this at all an unfair analogy, and I think in this particular instance that it is not at all strained. With regard to the Japanese theory, there is only one view I saw in the whole series that could be at all compared with Japanese work; that was a doorway with the ordinary horizontal lintel, which is exactly like the entrance to a Japanese dolmen, and equally like that of a dolmen in Brittany. There are many points that might be alluded to in this very interesting paper. I think that Mr. C. F. Wood's visit to the islands about 1873, and published in 1875, gives probably the best account of these extraordinary ruins. He was only in a small yacht, and had no crew sufficient to clear away the undergrowth, and made no excavations, but observed the structure, etc., very well. Up to the date of the publication of that book in 1875, I think his was quite the best account that has been published. The Duke of Wellington said that the battle of Waterloo was won in the playing-fields at Eton; here we have an exploit of a much more pacific character, which had its origin in the same training.

Mr. CHRISTIAN: With regard to what Admiral Bridge said, I want to say three or four things. First of all, the natives of Ponape are still clever architects. The photographs show us buildings in the same fashion as the walls at Metalanim, and there are several such indications along the coast which have been omitted. There is one where the masonry is very much the same; and certainly more recent than Metalanim; other ruins found on the island of Tapak are modern too. I think the builders were an intelligent minority swaying an ignorant majority. Yap traditions about the stone money go back a long way before there was any war in the land. They say after the invention of stone money civil war broke out.

With regard to bringing these masses of masonry into position, I think very likely it was done by a large number of men hauling them up over coconut trunks covered with oil to avoid friction. The point I considered Japanese as well as the great entrance was the projecting eaves or cornice that I have seen in Osaka and Kioto. The fashion of the mat, I was told by a Japanese the other day, was distinctly Japanese, as is their method of dealing with the banana fibre. I really think Mr. Reid was right in his parallel between the poor wretched fellaheen of Egypt to-day and the people under the Pharaohs long ages ago, and we must remember what Prescott has told us that nations fall to decay very quickly.

The PRESIDENT: It now only remains for me to propose a vote of thanks to Mr. Christian for his most interesting paper. It will have been new, I am sure, to most of the audience that there are existing such massive Cyclopean structures in these small and distant islands. They reminded me of what I used to study years ago in Captain Cook's voyages, of the great stone idols and platforms on Easter island, and I even used to have a suspicion that there had been connection between Easter island and the civilized peoples of South America. Though it seems most probable that the massive structures in the Caroline islands were built by ancestors of the present inhabitants, I do not believe it is altogether impossible that they were inspired by a visit of a higher race. We must all have been struck by the care and diligence with which Mr. Christian has examined and made plans of these ruins, and also with the excessively hard work which he must have gone through in clearing his way to them. We trust that he will complete his work in those islands when he returns, and that we shall have the pleasure of seeing him here again, and I hope, as Mr. Maudslay suggested, that before he goes he will make the acquaintance of Mr. Coles. I now have the pleasure of proposing a vote of thanks to Mr. Christian for his paper, and for the illustrations which accompanied it.

CAPTAIN SVERDRUP'S EXPEDITION TO NORTHERN GREENLAND.*

CAPTAIN OTTO SVERDRUP'S polar expedition, which left Christiania on June 24 last year, has for its principal geographical object to ascertain the extension of Greenland towards the north, to determine the yet unknown configuration of the coast of its mainland, and, if possible, to discover whether this great arctic land finally breaks up into groups of islands in the north.

The ship used in this expedition is the *Fram*, so well known from

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* The following account of the objects and equipment of Captain Sverdrup's expedition in the *Fram* to the north coast of Greenland has been forwarded to the President by Consul Axel Heiberg and MM. Amund and Ellef Ringnes, who contributed handsomely to Dr. Nansen's expedition, and who are generously bearing the entire expense of the present expedition in the *Fram*, the ship itself being provided by the Norwegian Government.

Dr. Nansen's famous polar expedition. It is the intention of Captain Sverdrup, with the aid of this ship, to force his way through Smith sound and Robeson channel as far north along the coast of Greenland as possible. Should it prove possible to take the *Fram* round the northern coast of Greenland and over to its eastern shores, this will be done, but the expedition did not base any positive calculations on this remote possibility. When the *Fram* has been forced as far north as the conditions will permit, the ship is to serve as headquarters for sledge expeditions for further exploration.

The principal purpose of these expeditions will be to explore and map out the northern mainland coastline, and to make an attempt to connect Cape Washington, the most northerly point known on the west coast of Greenland, with Independence bay and Cape Bismarck, the extreme northern points on the east coast. In case such an expedition should succeed, the Danish Government has, in Scoresby sound on the east coast, generously placed at the disposal of the exploring party a depôt of provisions left there by Lieut. Ryder's expedition 1891–92. The explorers will here find a place of refuge where they can make their winter quarters, if they wish, in order later on to return or to proceed southward to more civilized regions, as circumstances may render advisable. With the *Fram* as starting-point, other sledge expeditions will be sent out to explore the archipelago which may exist north of Greenland, and to make other more special investigations. This is, in short, the geographical programme of the new Norwegian arctic expedition, so far as it can be approximately outlined in advance.

The crew consists of sixteen members, not less than six of these being men of scientific education. Geology, botany, zoology, are all represented by specialists. The astronomical, magnetical, and other physical observations (among which are observations with Sterneck's pendulum),* will be taken by a naval officer, assisted by an officer of the army, who, besides, will attend to cartographic work. The expedition is also accompanied by a scientifically educated physician, who, among other things, takes care of the meteorological observations.

On board the *Fram*, as well as on the various sledge expeditions, there will be made as many specific scientific investigations, and as much scientific material will be collected, as the circumstances will admit. Particular attention will be paid to all glacial phenomena, and it is one of Captain Sverdrup's main objects to obtain a thorough knowledge of the exact nature of the so-called palæocrystic ice, found in these regions, of its origin, formation, and drifting.

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* Dr. Nansen also had a Sterneck pendulum on his arctic expedition. Lieut. Scott Hansen took with this pendulum on the ice, as was demonstrated later on, some very correct observations of gravitation in the polar region. This was the first time observations of this class were taken on the ocean. Dr. Nansen does not speak of them in his book, as he was not yet certain as to their correctness. By subsequent calculations their correctness has been fully established.

This polar expedition must be regarded as a natural continuation of the previous arctic explorations, under the leadership of Dr. Nansen, viz. the ski expedition across Greenland in 1888, and the *Fram* expedition in 1893–96, of which expeditions Sverdrup was a member. Of the latter he was second in command, and succeeded Dr. Nansen as commander when Nansen and Lieut. Johansen started out on their journey over the polar ice. By these expeditions important parts of the great polar problem have been solved, and it is now Captain Sverdrup's ambition to give to Norwegian arctic exploration, which has already produced such important results, a wider range, so as to complete in a measure what has been so well begun. To make this better understood, a few general remarks will perhaps be permissible.

The arctic researches of our times have been confronted with two conspicuous geographical conditions. Firstly, there was on the American side of the polar region a vast arctic continent—Greenland—the interior of which was wholly unknown, and the northern limits of which are still unknown. The second condition was the appearance of sporadic land-formations in the European-Asiatic polar regions, and the question would naturally arise, whether these continued sporadically in a northerly direction, and were finally connected with the possible offshoots of Greenland; in short, whether in the vicinity of the pole there was land or water. Dr. Nansen, in whose vivid, active mind the polar question early assumed a well-defined form, was first attracted by the mysteries of Greenland, that great, silent arctic country, whence the mighty icebergs break away and float with the currents from the north. What were the dimensions and extent of these vast masses of ice? What was the nature of the interior of this country? This, and similar questions, were in the main answered by his journey across Greenland ten years ago. But the question as to the northerly extension of this great white continent still remained unanswered.

Indeed, this question of the insularity of Greenland so much occupied the thoughts of Dr. Nansen that, having completed his journey across its glaciers, he for a time contemplated the fitting out of an expedition to solve that problem. Meanwhile, he preferred to engage at once in the solution of the other great polar question—the character of the vast region on the European-Asiatic side, our knowledge regarding the extension of land and water in which was still more imperfect than on the American side. The further investigation of Greenland he put aside for resumption at some future time.

The *Fram* expedition of 1893–96 established the fact that the European-Asiatic side of the polar region consists of an extensive, deep ocean, covered with drifting ice. The drift of the ice, and the great depth of the sea in the highest latitudes, make it, according to Dr.

Nansen, very probable that this ocean extends beyond the pole, and that the continent of Greenland, or its possible groups of islands to the north, cannot be presumed to reach a very high latitude. To solve this important problem is, then, the principal object of the expedition under the leadership of Dr. Nansen's able first officer. Captain Sverdrup has himself conceived the plan. It has grown on him ever since he enlisted in Dr. Nansen's first expedition across Greenland. Besides the broader views of the polar problem, mentioned above, Captain Sverdrup would naturally, from a number of circumstances observed during the *Fram's* long drift in the polar ice, be strongly interested in a further and more exhaustive exploration of the arctic regions on the American side.

THE RECONSTRUCTED *FRAM.*

Foremost among these was the ice problem. According to a theory generally adhered to, the European-Asiatic side of the pole consisted of a shallow body of water, covered with a stationary coating of ice. Instead of this, a vast, deep ocean was found, covered with drifting ice of local formation and of comparatively recent date, generally not more than five years old. The question then arose, What are the conditions as regards the formation and drift of the ice on the American side, influenced as it might be by unknown lands and ocean depths of a vastly different magnitude?

The ice conditions on the American side of the arctic region seem on the whole to be considerably different from those on the European-

Asiatic side. In the latter region we find only comparatively thin drifting ice, whilst in the former there seems to be much thicker and more stationary ice, the palæocrystic ice. Many interesting peculiarities, both in regard to formation and drift, may here be found, and the observation of these and other phenomena in connection with the exploration of the configuration and extension of the coast-lines, etc., will undoubtedly result in greatly increased knowledge of the entire arctic world. And in the interest of science, it must be looked upon as a fortunate circumstance that the same man is afforded an opportunity to make comparisons by direct observation between the conditions on both sides of the pole.

The chances of a successful issue of the present expedition will also be materially strengthened by the extensive practical experience gained by Captain Sverdrup from his previous expeditions, in regard to methods of travelling over land as well as over sea in the arctic regions. The double experience Captain Sverdrup has thus gained may now stand him in good stead in the American ice regions, where he will have to struggle with difficulties both on land and sea.

In the equipment of his expedition Captain Sverdrup has followed Dr. Nansen's plan, with only such modifications in detail as experience would suggest. The provisions taken are calculated to last for four years—the absence of the expedition is supposed to be two or three years—while particular stress was laid upon selecting such a variety that a monotonous menu would be impossible, and the fare of such quality, that it would at once ensure health to the body and good humour to the mind during the contest with the long arctic monotony. It stands to reason that these provisions to a great extent consist of all kinds of canned goods, meat, fish, soups, vegetables, and delicacies of every description. A considerable quantity of Prof. Waage's fish-powder—dried pulverized fish—which on the former polar expedition proved an equally nutritious and palatable food, was also taken. This fish-powder is very convenient for sledge expeditions, and can be used in different ways, as pudding, soups, etc. Instead of American canned meat, used by Dr. Nansen, Captain Sverdrup has furnished his expedition with partly Danish, partly Norwegian canned meats. The crew will be treated daily to fresh baked bread. Besides a large quantity of flour for baking purposes, a considerable amount of biscuit was taken to serve both as a change in the bread diet and as a reserve. To this was added the finest Danish butter, Norwegian canned milk, chocolate, and coffee. In provisioning the former expedition, Dr. Nansen enforced the most rigid prohibition as to alcohol, while the use of coffee was reduced to a minimum. After some time his stock of coffee gave out, and the crew thought it hard to be deprived of their coffee, the use of which is so very common in Norway. To avoid a similar experience, Captain Sverdrup has taken a sufficient supply of coffee to allow each man his daily drink of this beverage. On board the ship there is a stock of liquor comprising about 170 bottles of cognac. It was demonstrated on the former expedition, that one of the greatest difficulties to contend with was the arctic monotony and its depressing influence on the mind. A festal gathering now and then around a social glass tends to relieve the monotonous uniformity, and to bring about a change in the daily routine; it will be admitted that 170 bottles divided among sixteen able-bodied men over a period of three or four years, can hardly afford an opportunity for abuse. A sufficient supply of tobacco was also laid in for the use of the members of the expedition.

For the intellectual diversion of the expedition, a library of several hundred volumes, consisting principally of books used on the former expedition, was taken. A considerable number of new books was added, however, and the saloon furnished with a piano for the musical entertainment on board.

It will be remembered that the Nansen expedition used electricity for lighting purposes, the power for which was generated by a windmill. The light was pleasant, but the machinery occupied a great deal of much-needed space, and required very minute and close attention. Captain Sverdrup decided to use petroleum, both on account of the reason stated above and because it produces heat as well as light at the same time. Even the cooking is done by petroleum, thereby saving for other purposes space that otherwise would have been taken up by coal and coke. The kitchen stove is constructed on the so-called Primus principle, the oil being transformed into gas before it reaches the burners. For the ship's boilers, on the other hand, coal is used exclusively, petroleum having given rather unsatisfactory results on the former expedition.

Another departure from the Nansen equipment, made by Captain Sverdrup, is the use of 6½ mm. Krag-Joergensen rifles, while Dr. Nansen used 8 mm. size. Thus a considerable saving is effected in the weight of ammunition, which is of particular importance in the making up of the sledge-expeditions. In this connection, it may also be mentioned that Captain Sverdrup carries with him an ample supply of gun cotton and gunpowder for ice-breaking. The excellent manner in which Captain Sverdrup succeeded in getting the *Fram* out of the polar ice was in no small degree owing to the use of submarine mines, laid under the direction of Lieut. Scott Hansen. Captain Sverdrup is prepared to make liberal use of this method, should it prove necessary.

The outfit in regard to ski, snow-shoes, sledges, and kayaks is in all essential features the same as used on the last expedition. A few modifications have been effected in the construction of the sledges, in order to increase their durability in crossing the rough ice-field. Of particular interest is the change made in some of the kayaks. Dr. Nansen and Lieut. Johansen found, during their long wanderings over the ice-fields, that it was frequently necessary to transport the boats on the sledges over the solid ice, next to transport the sledges on the kayaks over the open lagoons between the ice-floes. To avoid loss of time as much as possible in changing about in this manner, Captain Sverdrup has furnished his boats with runners. When the kayaks are transported over ice, they slide on their own runners, with the keel turned up. When open water is reached, the kayak is simply turned over into its natural position as a boat, with the keel in the water.

The *Fram* has also undergone some changes, mainly with a view to obtain better accommodation for the crew. Under the old arrangement the crew had their quarters in the stern, which rose considerably above the fore part of the ship. Captain Sverdrup has had the whole of the fore part built up in line with the aft section. On the top of this reconstructed fore part he laid a new deck, and below this he had accommodations fixed up for a part of the crew. Below this deck are located the laboratories and cabins for the scientists as well as for the officers, and a saloon to be used as a drawing-room for the entire crew. Aft of these accommodations is a roomy place, where all the mechanical work is attended to. Adjoining this is the galley, where the food of the crew is cooked and prepared. Aft of these new sections, and lower down in the ship, are located the old salon and cabins of Dr. Nansen and his fellows. These cabins, which are supposed to offer more resistance to the cold than those newly constructed in the fore part of the ship, are principally occupied by the more subordinate part of the crew.

The rebuilding of the *Fram* was left in the hands of Colin Archer, the constructer of the vessel.

On Dr. Nansen's expedition the principle of democratic equality was enforced to its extreme point. Every member was placed on the same level and performed the same duties, and as every one was compelled to share in the daily routine work, so they were all entitled to the same privileges. Captain Sverdrup, while not breaking with a principle that produced such excellent results, has, however, in the present instance, found it advisable to modify Dr. Nansen's system to a certain extent. He has, as mentioned above, installed the officers and scientific members of the expedition foreward, while the rest of the crew are given quarters aft by themselves. The scientific members are thus enabled to pursue their special line of work quite undisturbed, while the others are relieved of any feeling of intrusion. The ordinary good fellowship and mutual interests are maintained by the common mess and by other special gatherings.

In manning the expedition, special consideration was given to securing men of as uniform education as possible. With perhaps the exception of two or three men, all the sixteen members of the crew have graduated from some higher, lower, or special institution of learning. As another striking fact it may be mentioned that a great number of the men are married. An effort was made to secure unmarried men for the expedition, but although several hundred applied, they were mostly found to be married. Two bachelors who were among the accepted ones, and who, on account of their singleness, were pointed to with particular pride, went off and got married directly before the expedition started.

At the farewell dinner in honour of the expedition given by the Norwegian Geographical Society, Dr. Nansen proposed the following toast to Captain Sverdrup:—

"I have to confess to a most unusual sentiment this evening, as my old friend and comrade stands ready to depart in the same ship and for the same northerly destination, where we spent so many days in each other's company. Many are the memories which this evening recalls to my mind from the time we were together. I am particularly reminded of the time when I was preparing to start on my Greenland expedition. Sverdrup had applied for permission to join. I received one day a letter from an unknown man, signing himself Otto Sverdrup. I made the usual inquiries, resulting in such information that he was immediately accepted. I need not say that I never had a chance to regret this choice. I have often been thinking how the fates of two human beings are sometimes interwoven. That accidental meeting was destined to become momentous, not only to ourselves personally, but also to the country. It was then Sverdrup formed his attachment for the life up north, where his life-work undoubtedly lies marked out, in the performance of which a little more than ordinary courage and presence of mind is required. Among the many memories from the Greenland expedition, I am at this moment particularly reminded of Sverdrup's famous night watch on the drifting ice-floe, when the entire expedition seemed to be left no alternative between drifting out on the ocean or being crushed among the ice-floes. When, after that solitary watch, I asked Sverdrup how he had passed the night, he said, 'Oh, it looked quite bad for a while, with an iceberg outside threatening every moment to crush down on the floe; but what would have been the good of it if six men had been standing glaring at it instead of one?'" Dr. Nansen next referred to the second polar journey, and spoke of the splendid manner in which Captain Sverdrup had taken the *Fram* out of the ice as an accomplishment that stands without a parallel in the history of polar exploration. "And when Sverdrup now once more is starting out, we all know that the expedition is safe, and that it will return, because we know Captain Sverdrup is keeping watch, that he is at the helm. It is superfluous to tell him; he knows that all my best wishes follow him. Many a winter eve my thoughts will turn tenderly towards the far north, and my heart beat faster for those who are there."

Captain Sverdrup's second in command is Lieut. Baumann, of the Norwegian navy. He has charge of all magnetical and astronomical observations. He is assisted by Lieut. Isachsen, of the army. The latter also attends to the cartographical work. The zoology is attended to by a young Danish scientist, Mr. Bay, who in 1891–92 was a member of Ryder's expedition to the east coast of Greenland. The botanical work is placed under the direction of Mr. Simmons, who is a specialist on sea algæ; some years ago he made a botanical expedition to the Färoe islands. The geologist of the party is Mr. Schei, a graduate of the geological and mineral faculty of Christiania University. Mr. Svendsen, the physician of the expedition, who also has in charge the meteorological observations, is a graduate of Christiania University.

The expedition left Christiania on the 24th, and Christiansand on June 27. On July 28 they arrived at Egedesminde, Greenland, after a comparatively rough journey and continuous contrary winds, causing much delay and annoyance. At Egedesminde thirty dogs, procured for the expedition by the kindness of the Royal Danish Trading Company of Greenland, were taken on board. On July 30 the *Fram* arrived at Goodhavn, where other thirty-five dogs, also purchased by the Greenland Company, were added to the stock already on hand, and where the ship coaled for the last time.

At Upernivik, where the expedition arrived on August 4, another batch of dogs was received, increasing the total number of these animals to about a hundred, including fifteen dogs taken from Norway. The expedition should have left Upernivik on August 5 for the far north. Upernivik is the station where the expedition was last heard from. According to all reports so far received, either from the leader or his associates, it appears that the prevailing sentiment on board is one of mutual satisfaction and good cheer.

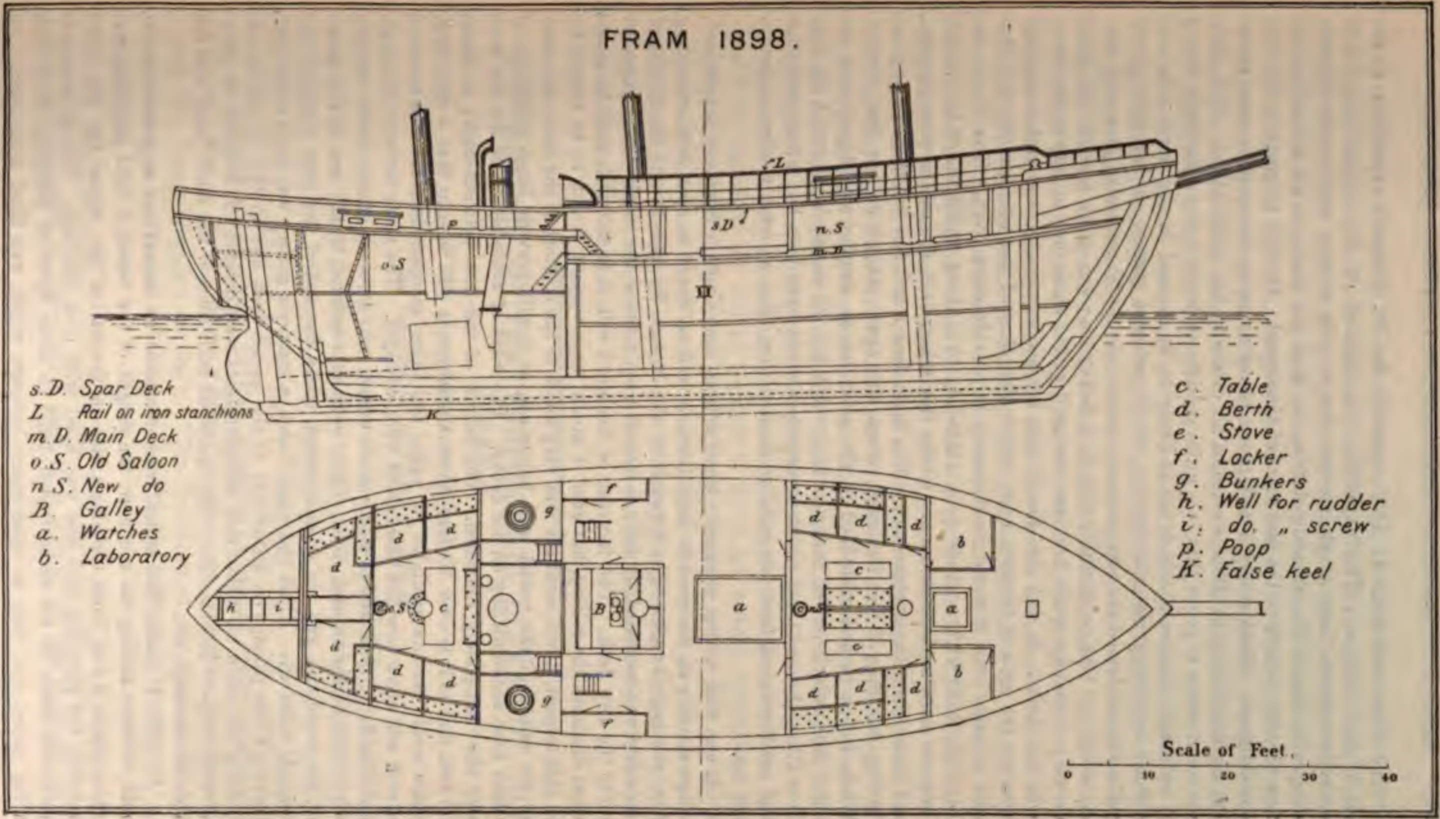
It was the intention of Captain Sverdrup to leave information as to the fate and progress of the expedition at the following points: Littleton island (principally on the south side); Crozier island, or Franklin island, or Cape Constitution (in any case at southernmost point); Polaris House (on the south side of Newman bay); Cape Sumner (the northernmost point); Cape Brevoort (on the north side of Newman bay, at the most extreme southern point); Cape Stanton (at the extreme northern point); Frankfield bay (on the promontories at both sides of the bay); Cape Bryant (extreme northern point); Cape Cleveland (extreme northern point); Cape May (extreme north-westerly point); Cape Britannia, Cape Fredrick, Cape Neumayer, Cape Ramsey, or Mary Murray island, or Lockwood's farthest.

The Danish Government, as already will be seen, has shown great interest and kindness towards the Sverdrup expedition, and the Government has also given orders to all Danish officials in Greenland to assist the expedition in every possible manner.

The *Fram* is owned by the Norwegian Government, which also furnished the money for her reconstruction, while the expenses of the expedition are defrayed by Mr. Consul Axel Heiberg and Messrs. Amund and Ellef Ringnes.

It was a special wish of Captain Otto Sverdrup that his plans should be laid before the Royal Geographical Society.

Appended is a description of the reconstructed *Fram* by Mr. Colin Archer:—



THE RECONSTRUCTED *FRAM*; PLAN AND SECTION.

The *Fram* was built in 1892, specially for Dr. Nansen's expedition to the north polar regions. This expedition was planned on the supposition, which subsequent events have amply verified, that a polar current would carry the ship along with masses of constantly shifting ice from the tracts in the vicinity of the New Siberian islands to the east coast of Greenland. On this assumption the ship was designed. Great strength and power of resistance to ice-pressure were therefore the considerations which overruled all others in her construction. But while the event seems to prove that it is quite possible to build a ship sufficiently strong to resist any pressure to which she is likely to be exposed in the north polar seas without sustaining material damage, the experiences gained on her three years' cruise also confirmed the supposition to which her model naturally gave rise, that she would not be a comfortable ship in a heavy sea; her great beam would cause her to roll heavily, while her low freeboard would cause her to ship water freely over her decks. It was also found that her accommodation was rather confined even for the crew of thirteen men, which then formed her complement, and that with a larger crew it would be necessary to provide more room. The *Fram* was originally built with a raised poop extending over about two-fifths of her length from the stern to the mainmast. Under this raised deck the cabins were situated, and under them the engine-room. The main deck was 3 feet lower than the poop, leaving less than 2 feet freeboard, when the vessel started on her first voyage. While frozen in and embedded in the polar ice, an awning was rigged over the main deck, which proved sufficient to prevent the ice accumulated round the ship from filling the decks, but which nevertheless would have been but a frail protection had not the vessel, from her peculiar construction, risen so readily when nipped in the ice.

It was with a view to remedy these defects that Captain Sverdrup determined, before starting on his present expedition, to add an upper or spar deck, extending from the engine-room right forward to the bows. By this means the freeboard amidship was increased by fully 6 feet, the top sides of the vessel being extended up to the new deck. The increase of freeboard will, it is thought, tend to somewhat diminish the rolling, but even if much improvement is not to be looked for in this respect, it will certainly add very much to the comfort of the crew, and even to the safety of the vessel in a heavy sea, as it will prevent large quantities of water from accumulating on her decks. The want of available space for the crew was also completely remedied. The length of the new between-decks is about 68 feet, and as it is over 30 feet broad amidships, it will be seen that a very large space would become available for cabin and other accommodation. The annexed sketch will show how the new cabins were arranged. The space between the main and fore hatch from side to side was converted into a roomy saloon in the middle, with three berths on each side. These were appropriated to the use of the leader of the expedition and his scientific staff, while the rest of the crew occupied the original cabin aft. Abaft the main hatch a spacious gallery was built amidships, leaving a free passage on either side to the upper deck and to the old cabin. In front of the cabin on either side compartments were divided off, intended to serve as workshops or laboratories. The spaces on both sides of the main hatch was left open for stowage, etc.

In order to make this added accommodation as impervious as possible to the cold, without adding too much to the weight of the vessel, a light panelling was added about a foot from the ship's side in the wall of the cabins, and the space between the panelling and side was filled with cork shavings. The athwartship partitions were, for the same reason, built in three layers of panelling lined with thick paper, and with an open space between, which was filled with cork. An extra ceiling was also added between the upper deck beams, and the space between the ceiling and deck filled with the same material. The saloon, as well as the side berths, receive their light from a large double-glazed skylight over the middle of the saloon, no bulls-eyes or side lights being fitted, in order to reduce the radiation of heat as much as possible. A good stove is fitted in the cabin, with means of ventilation. By these means it is expected that the new cabins, if not quite as impervious to the arctic frost as the old ones, will still be quite habitable and comfortable even in the severest cold.

In order to render the vessel as invulnerable as possible when nipped in the ice, she was originally built with very little of the keel projecting below the bottom planking. This absence of keel had the effect of making her exceedingly quick in turning. If the helm was put hard over even at full speed, she would literally turn round almost in her own length, as if working on a pivot. This property, however valuable when threading one's way between ice-floes, made her difficult to steer in the open, as there was nothing to steady her and keep her in a straight course. To remedy this yawing tendency, and also make her hold a better wind, a false keel was added 15 inches deep at the stern, and tapering to nothing at the fore foot. This keel was fastened with spikes only, not through bolts, so that if caught by the ice it may be wrenched off without seriously injuring the main keel.

The foremast, which was originally shorter than the mainmast, was lifted 7 feet and stepped on the lower deck beams, and it has now very nearly the same height as the mainmast. Before leaving the vessel was hove down to have her bottom cleaned and the greenheart ice sheathing recaulked.

These are briefly the principal alterations effected to render the *Fram* more suited for the work she will be required to do on her second expedition. It is worthy of note that, after what she had gone through on her first voyage, no repairs whatever were found necessary to any part of the hull, no damage having been sustained. No sign of weakness or straining could be found anywhere. All her seams and joints seemed as close as when she was launched, and not a bolt or tree-nail had to be renewed.

EXPLORATION OF THE INTERMEDIATE DEPTHS OF THE OCEAN.*

(PRELIMINARY REPORT.)

By GEORGE MURRAY, F.R.S.

THIS expedition, for which funds had been provided by the Royal Geographical Society, the Drapers' Company, and the Fishmongers' Company, sailed on November 15, in the *Oceana*. The party consisted of Mr. George Murray, F.R.S., Mr. L. Fletcher, F.R.S., Dr. Gregory, Mr. V. H. Blackman (all of the British Museum), Captain Bates (navigating officer), Mr. J. E. S. Moore (Royal College of Science), Dr. Sambon, and Mr. Percy Highley (artist). The Trustees of the British Museum granted special leave of absence to Messrs. Murray, Gregory, and Blackman.

By the kindness of Mr. S. W. Silver, the *Oceana* was fitted with her hauling-gear at Silvertown, and it is owing to his interest in the expedition, and to the endless kindness and resource of Mr. M. H. Gray, that the expedition sailed so perfectly fitted for the work undertaken.

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* Diagram, p. 224.

On the passage from Silvertown to Queenstown, every one was fully occupied in unpacking apparatus and fixing it in position in the small temporary deck workroom and in the forehold, etc. The serial tow-nets were towed on several occasions to get the silk properly seasoned, and the sounding-gear, accumulators, etc., were carefully overhauled. In the first of these preliminary tow-nettings, off the North Foreland, a few miles from land, coccospheres were obtained with coccoliths of the type described by Messrs. Dixon & Jolly (*Nature*, September 10, 1897) in Dublin bay, viz. *Coccosphæra pelagica*, Wall. A reference to Messrs. Murray and Blackman's paper on "The Nature of the Coccospheres and Rhabdospheres," in *Phil. Trans. Roy. Soc.*, 1898, will show the interest that belongs to this observation. Finally, the Tanner opening and closing tow-net was carefully adjusted.

A call was made at Queenstown for the parts of the opening and closing tow-net invented by Mr. M. H. Gray a few days before sailing, and unfinished when the *Oceana* left Silvertown. The opening and closing apparatus in this instrument is regulated by a mercury clock, and its adjustment being a matter of great nicety, Mr. Gray determined to give it some further attention, and it was sent overland to meet the *Oceana*. Two special spars, judged necessary for the hauling-gear and sounder, were also obtained, and after two hours in Queenstown the *Oceana* sailed for her point of departure, viz. Tearaght Light, off Dingle bay. This point was selected for several reasons. In the first place, it would be easy in any weather, by day or night, to pick up the indicated 100-fathom line, 25 knots due west of this light, visible 22 miles; secondly, a due west course would follow a line drawn by Admiral Wharton, along which soundings were desirable; and, thirdly, this region was imperfectly known, especially as to the winter fauna.

The object that now engaged all the resources of the expedition was to obtain specimens of the inhabitants of what are known as the intermediate depths of the ocean. It has been generally agreed by naturalists that the surface life extends down to approximately 300 fathoms, and that the deep-sea life rises to about 100 fathoms from the bottom; but two opposed opinions were held as to the question, Are the dark depths lying between these zones inhabited, or are they destitute of living organisms? One party, headed by Prof. Agassiz, contends that these depths are barren of all life; the other, most conspicuously represented by Sir John Murray, believes that they are inhabited. This geographical problem, Is this zone, in places several miles thick, extending over nearly three-fifths of our globe, a desert or not? was to be attempted by two methods: viz. (1) by the use of a series of ordinary tow-nets, towing at ascertained depths, the contents of which should be subsequently carefully analyzed, and the surface forms, as indicated by those obtained in the surface nets, subtracted from the total catch of the deeper nets, so as to discount those organisms captured during the descent and ascent of the nets; and (2) by the use of opening and closing nets. Besides the Gray net already mentioned, the Tanner net, on the evidence of which principally Prof. Agassiz bases his contention, was part of the equipment. It is lowered tail first into the depths, so that it can catch nothing in its descent; then towed at the desired depths and closed by the descent along the rope of a messenger, which on striking a hook, releases a constricting cord, and thus secures the tail of the net against collecting during its ascent.

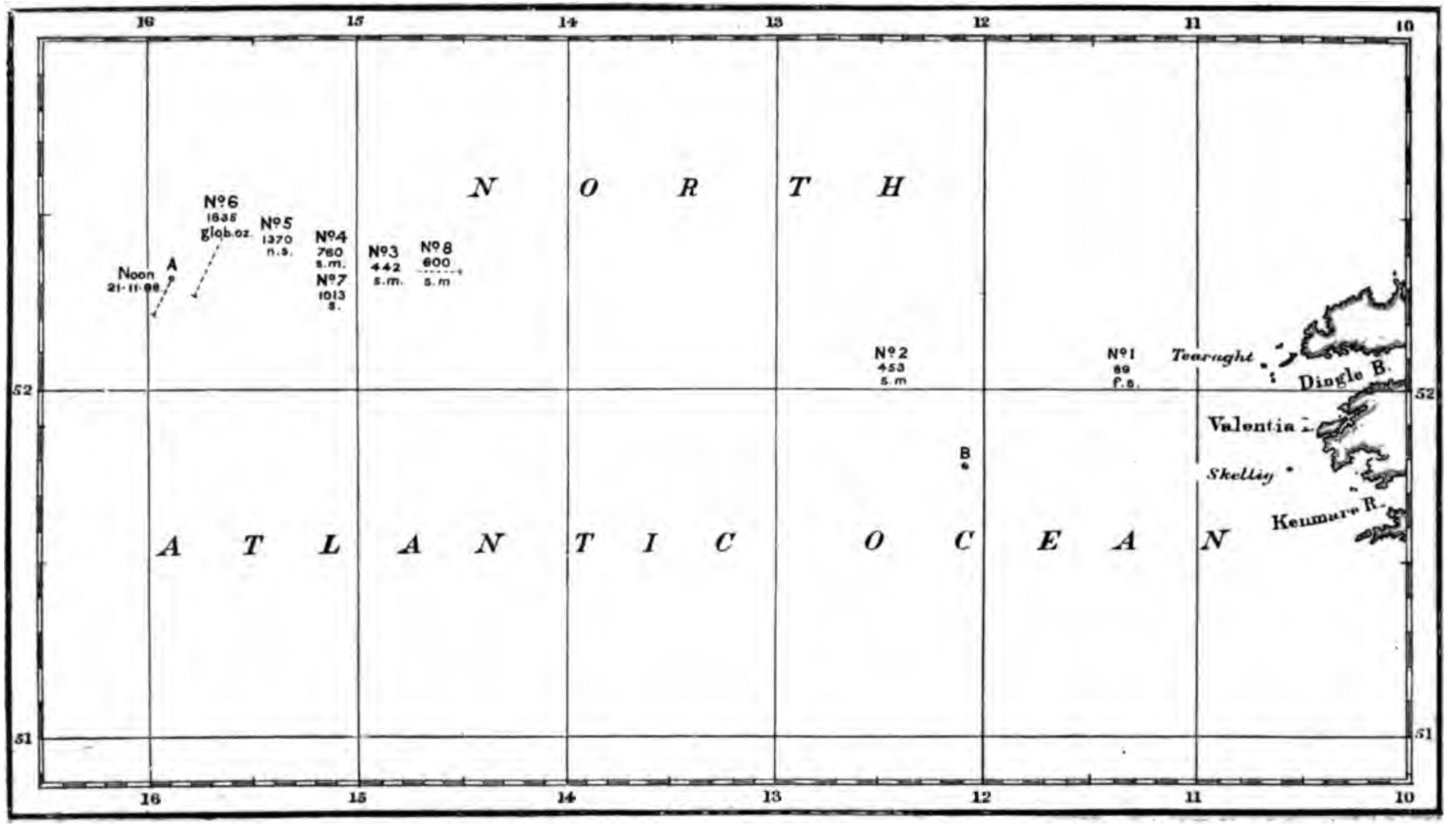
Before daylight on the 19th there were few idle hands on the *Oceana*, since the heavy spar from which the hauling-gear was to run had to be hoisted and secured in the fore-rigging, and a slighter spar aft for the Silvertown sounder. Tearaght Light was still burning when, at 7.20 a.m., the *Oceana* took her departure due west from this point, and at 10 a.m. was in lat. 52° 4′·5 N., long. 11° 21′ W., the estimated position here of the 100-fathom line. The sounding gave 89 fathoms, with a fine sand bottom, and immediately it was obtained, hauls of the open nets were taken at the surface, 20, 50, and 75 fathoms. Proceeding along the same parallel, at 3.30 p.m. the *Oceana* was in long. 12° 27′ W., and the sounding gave 453 fathoms (sand and mud). The serial open nets were again used at various depths, and when they were hauled in, the Tanner net was sent down at 7 p.m.

The stranded-wire rope used for tow-netting passed from its storage drum to a hauling-drum attached to the steam-windlass of the *Oceana*, and thence over a block depending from indiarubber accumulators of the Admiralty pattern on the end of the heavy spar. The behaviour of the accumulators was now watched with interest, and though they perceptibly stretched, and during later and deeper hauls stretched considerably, there was never at any time the least evidence of any elastic play; in short, there was never the least sign of their being of the smallest use, though at the last a heavy sea was running, and at no time was it other than a fairly heavy swell. This result was attributable to the great elasticity of the stranded-wire rope, which distributed throughout its length the strain of the up-and-down movement of the ship. The lesson to be learnt from this clearly shows the advisability in future operations of using a rope of this elastic character, the breaking strain of which must not be too much in excess of the actual strain employed. Under these circumstances, as in the present case, accumulators are unnecessary, and it is plainly better to have the strain thus distributed than to trust to the best accumulators, in which there must always be a certain amount of jerking. In all these deep hauls not a single net was lost by the heaving of the ship, even in the last haul during a heavy westerly gale. Owing to the smallness of the block on the accumulators, the manila rope could not pass, and the deepest hauls were taken over an "old man" block, without accumulators at the deepest and most critical part of the operation.

The soundings, taken aft, were all hove in by hand, the members of the expedition taking turns in pairs at heaving in. A ludicrous mistake attended the first sounding in 89 fathoms. It was hove in by Mr. Murray and Captain Rickman of the *Oceana*. Their exhausted condition filled the others with dismay at the prospect of doing their share of a 2000-fathom sounding, but this feeling gave way to others when it was discovered that they had done their work with the brake down!

The Tanner net having been got in, it was discovered that, though the messenger had released the closing-cord, this cord had hitched over one of the clamps of the lock and so kept the net open. One of the troubles of this net, viz. that on lowering it *down an incline*, the hook would almost certainly release the constricting cord before it had gone far, had always seemed to some critics an explanation of Prof. Agassiz's failure to catch anything with it—the basis of his argument. At the last moment before starting, Mr. Gray had, with his unfailing resource, suggested lashing the hook with fine copper wire, which should be severed by the heavy messenger at the critical moment, and it was found that this precaution had succeeded exactly as he foretold. At 10 p.m. the *Oceana* set on to run 100 knots west true.

On Sunday morning (November 20) at 3 a.m. the wind freshened and the sea increased, but the conditions of work were not rendered much the worse. At 7.35 a.m., having run 91 knots on a west true course, the *Oceana* stopped in lat. 52° 21′·9 N., long. 14° 52′ W., and then commenced the most arduous day's work during the expedition, continuing with few relaxations until 1 a.m. on Monday morning. It was expected that the *Oceana* was now well down the Atlantic slope, but the sounding gave only 442 fathoms, viz. 11 fathoms less than the last, 91 knots nearer the coast of Ireland. It seemed that she was here crossing a southern prolongation of the "Porcupine" bank. At 8 a.m. she again set on her westerly course, and at 9.30 sounded in 760 fathoms in lat. 52° 23′·8 N., long. 15° 7′·9 W. At 10 a.m. she set on again to run 10 knots on same course, and at 11.10 (lat. 52° 25′·7 N., long. 15° 23′·8 W.) sounded again. At 1370 fathoms the wire parted without reaching bottom, and carried away a Sigsbee sounder—the only instrument lost during the expedition by such an accident. After running the same course for another 10 knots, another sounding was taken in lat. 52° 27′·6 N., long. 15° 40′ W. at 0.55 p.m., and bottom was found at 1835 fathoms. It was a tough business getting all this wire (with the Sigsbee) in by hand, since only two men could haul at a time. The iron handle bore such striking traces of this effort in its twisted condition, that it was decided to preserve it, but its appearance so outraged the best professional feelings of an engineer of the *Oceana*, that he surreptitiously straightened it again. One hundred fathoms for each pair was hauling enough, and



SOUNDINGS IN THE NORTH ATLANTIC.

the combined muscle of the members of the expedition and the ship's company was not much more than sufficient for the work. The barometer was rising, and without cessation of work the operation of tow-netting down to the greatest depth was commenced. All the wire rope, viz. 1500 fathoms, was paid out, and the end spliced on to a 2-inch manila rope, of which 500 fathoms was also paid out. This operation was conducted very slowly—more slowly than the risk of bursting the silk nets warranted—for the reason that it was desired to preserve the delicate organisms captured from the least risk of crushing. The last tow-net came in at 1 a.m. on Monday morning. The operation entirely justified Mr. Murray's preference for hauling in by night, since the luminosity of the nets far below the surface gave ample warning of their approach—a matter of importance when careful measures for immediate preservation of the contents have to be taken. Mr. Blackman, who took charge of the fixing and preservation of the material, and Dr. Gregory, who computed the positions of the nets and observed the amount of rope paid out and hauled in, undoubtedly slept soundly during the few hours that followed before the next observations. It was decided to remain in the same spot, as near as might be, and to repeat the observations.

The following morning was spent in an effort to do justice to the claims of the Tanner net. It was sent down to 650 fathoms, every conceivable precaution having been taken to ensure a successful haul. The apparatus acted as required; the messenger severed the wire lashing and released the constricting cord. The lower part of the net came up empty after prolonged towing, and with very few organisms in the upper part. It was impossible to resist the conclusion that there is something amiss in the balance of the net, which so tilts it as to seriously interfere with its catching powers. However, this may be a hasty conclusion, and farther experiments may possibly prove it to be wrong. Dr. Gregory and Mr. Fletcher spent the morning adjusting the Gray net. At 2 p.m. another deep haul was taken of the serial nets, tangles, and thermometers (Miller-Casella, Buchanan's pattern). This was completed in slightly better time, since all the attachments of lengths of manila rope had been made on the previous day. The haul was in all respects successful except as regards the tangles, which caught nothing. It was then determined to commence the return course, and next morning (lat. 52° 20′ N., long. 15° 7′·9 W.) a sounding was taken in 1013 fathoms, and after running 15 knots farther to the east, sounded again in 600 fathoms (same latitude, long. 14° 43′·1 W.). This sounding in 600 fathoms was nearer land than the sounding in 442 fathoms mentioned above. A haul of the serial nets was taken in this more shallow water, and experiments were also made with the Gray net, in which, most unfortunately, a delicate spring broke in the heavy sea then running, and it was impossible to do more than satisfy the members of the expedition that in it, at all events, the right principle had been discovered for an instrument of this sort. The last nets were got in while a strong westerly gale was rising, and without mishap, by careful watching. This position was the one selected for lowering two large fish-traps, one to the bottom in 600 fathoms, and the other in 300 fathoms. Preparations had been completed for buoying them, and the disappointment of all became more and more acute as the gale increased and the barometer sank lower and lower. The *Oceana* was kept head to sea in the lingering hope that the weather might moderate.

It will give some idea of the weather met with here when it is stated that no great distance to the south the unfortunate Wilson-Furness liner, the *Londonian*, was lying, during this night, disabled by the same gale. Things grew worse instead of better, and finally Mr. Murray decided to run before the gale and abandon the fish-trap part of the programme.

There are two schools of tow-netters: the old-fashioned method, here employed, by which the nets are towed horizontally; and the new method, by which an opening and closing net is let down as vertically as may be, and hauled in open through a given vertical area and then closed. Both methods have their advantages and their disadvantages. It is objected to vertical fishing that only small quantities are obtained under ordinary circumstances; and it is objected to horizontal fishing that there is a difficulty in estimating the positions of the nets, though a similar objection applies in a less degree to so-called vertical fishing, which can never be truly vertical while ships drift down the wind and currents flow in the sea. Mr. Murray had convinced himself by experiments (under 100 fathoms), made from the *Garland* in ascertained depths and with ascertained lengths of rope, that much of the objection to horizontal fishing had no greater weight than belongs to armchair disputations on the subject. In the accompanying diagrams, giving the estimated positions of the nets in three typical tow-nettings during the *Oceana* expedition, the outcome is given of the working method employed in Dr. Gregory's calculations. His main difficulty was the serious one of the employment of both wire rope and manila rope—the resistance of the rope being greater than the opposing action of its weight, while the resistance of the wire is less than the influence of its weight. In working in these great depths, Mr. Murray never expected to do better than come within 100 fathoms of the actual position, however carefully and unceasingly the ship's drift be watched. No more eloquent testimony to Dr. Gregory's success in computing the lengths of rope to be paid out could be cited than the following incident. In one of the deepest hauls the lowest net was set to tow 10 fathoms from the bottom, with slender hopes, it must be admitted, of ever seeing it again. In the result this net came up with a small quantity of ooze in it. It had not hit the bottom, or it would have been burst and had its rim indented, and yet it had come near enough to gather ooze, probably stirred by the 60-lb. sinker. This conclusively proves the accuracy of the curves, since had they been less sharp the lowest nets must have fouled the bottom, and had they been sharper the lowest net would not have reached this muddy zone. This almost incredible witness to the accuracy of Dr. Gregory's computation (made rapidly on deck when told the estimated drift) was received on board with a welcome exceeding even that natural to its being the last of a long spell of continuous work on a wintry day and night in the North Atlantic.

One small incident is worth recording. There was some curiosity to observe the action of great pressure on wood in a great depth, and it had been intended to lower a suitable piece. This was forgotten in the hurry of attending to more important things, until so much wire had been paid out that it was possible to experiment only with 500 fathoms. A piece of common deal matchboarding was sent down, and since it came up apparently unchanged, deep-sea pressures were openly derided by some of the more frivolous members of the expedition. On the following day, while pieces of wood were being thrown overboard to assist in estimating drift, this piece, which had been left on the deck, was thrown in its turn. It instantly sank.

Next day the wind slowly fell, but the sea still ran very high, and the barometer continued to sink. Towards evening it began to blow from the north-east, and soon it blew a whole gale from that quarter. Its action on the great waves still running up from the west was, while it lasted, most impressive. At 2 a.m. on Thursday morning it was decided to make Queenstown for shelter, and on arriving there the *Oceana* was detained for thirty-six hours. The weather then moderated sufficiently to permit of the return passage to Penarth.

It will take several months to complete the analysis of the contents of the tow-nets, and when this has been done, a report of the result will be communicated to the Society. In the mean time there is full confidence that the material obtained will permit of a decisive answer.

Where every one worked hard, with zeal and loyalty to the objects of the expedition, under circumstances in which overcrowding and squalor were tempered by long periods of exposure to very fresh air and water both separately and in combination, it may seem to others than the members of the expedition themselves invidious to mention the work of any one man. Captain Bates, at a few days' notice, joined as navigating officer. He had not the primary scientific incentive of the other members. Spurred only by a sense of duty and comradeship, he was not only navigating officer, but able seaman, mechanician, and standing example of the truth that when you want a thing well done, get a sailor-man to do it.

A JOURNEY TO NORTHERN TIBET AND AKSAI CHIN.*

By Captain H. H. P. DEASY.

STARTING from Khotan on May 18, 1898, I took the direct route to Polu *viâ* Utroki, Hasha, and Nura, in the hopes of getting fine weather, and being able to get a good value for my longitude by triangulating from two peaks, fixed by the Survey of India, in the Tekelik Tagh. For this purpose I halted for nine days close to the peaks I wanted to observe, but unfortunately the hazy season had commenced, and I was unable to see either peak.

The Bey of Polu having informed me that the direct route to the Aksai Chin *viâ* the At To (horse's back) pass, called Ghubolik At pass on the R.G.S. map of Tibet, is closed to all, natives of Chinese Turkestan included, since the murder of Dutreuil de Rhins many hundreds of miles away, I wrote to the Amban of Keria for permission to use that route, as my passport covers the Aksai Chin, and, pending a reply, camped on the high plateau close to, and about 2000 feet above, Polu, in hopes of getting a fine view of the Kuen Lun range. There I was again unfortunate, and during the fortnight that I was obliged to spend at Polu and its vicinity, only on one day, and then merely for a few hours, were the fine snow-peaks of the Kuen Lun range clearly visible. The Amban of Keria, who several times informed me that the Aksai Chin is part of the province of Sin-chiang and under his jurisdiction, refused to allow me to use the Polu route, and would not permit me to obtain sufficient supplies at Polu. Being short of transport, owing to the sheep not having arrived from Tadakh, I was forced to go to Keria to obtain more transport, and again asked for permission to travel *viâ* Polu to the Aksai Chin, but was again refused. As my passport, which was shown to the Amban of Keria, includes the whole of Chinese Turkestan, I fail to see any reason for that official ignoring it and refusing to allow me to use the direct route to that part of his district, causing me considerable delay and inconvenience, not to say extra expense, by forcing me to take the lengthy route *viâ* Sorgak, Kara Sai, and Tibet.

From Kara Sai the ascent to the Tibetan plateau is very easy, being for most of the way up the gently sloping valley of the Tolan Khoja river. To about halfway up this valley there is plenty of excellent grass, but for the latter part it was necessary to supplement the scanty supply of burtza with bhusa. The pass at the head of this valley is a very easy one, and from a little way south-west of it, the Shor Kul depression and adjacent mountains are plainly visible; but, alas! the country thereabouts is barren and waterless, with the exception of close to Shor Kul, where there is a fair amount of coarse grass called lungma by Ladakis and Tibetans, and but very scanty supply of fresh water, Shor Kul being a salt lake.

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* Dated "Yarkand, October 31, 1898."

The general run of the Kuen Lun range for some distance west of Polu is along lat. 36° N., but a little way east of that village it is several miles north of that parallel, continuing slightly north of east to the Tolan Khoja river. East of this river there are no snow-peaks, at least for some distance east of Kara Sai, the range rapidly becoming lower; and only very low grass-covered hills have to be crossed between that place and the long valley of the Tolan Khoja river. Part of this valley as far as Yaluk is called Tolan Khoja, and above this place Sarok Tuz (yellow salt). Having been told by the men of a temporary post that the Amban of Keria had established at Yaluk, in the Tolan Khoja valley,—nominally for the purpose of rendering me assistance and providing supplies, but really merely for show,—that there is a southerly route from there to Ladak, I went some distance up the most likely looking valley in search of it; but I was forced to return, as the valley became too narrow and rocky for laden animals, while not a blade of grass was to be found in it, and the very high barren mountains, with almost vertical sides, limited the view to a few hundred yards towards the mouth, and considerably less higher up. Repeated attempts were made to find a route other than that by Shor Kul, but the utterly barren nature of the country certainly as far south as lat. 35° 30′ N., and the great probability that it is waterless too, constituted a strong natural barrier which I did not consider it advisable to try and pass. There were many natives with me only too eager to earn the rewards I offered if another route was found, but all declared the country to be barren and waterless, and from what I saw of it I can corroborate their statements.

For some weeks after leaving Kara Sai the weather was exceedingly bad, snow falling continually in July, and I was unable to take observations for some time, or to see any distant peaks. Besides this cause of delay, illness was another, dysentery, chest, and liver diseases being the principal ones I was called upon to treat. While I went west from Yepal Ungur, on the Keria river, three exploring parties were sent out to try and find routes in any direction between east and south. But though the men were warned not to, on any account, go north of the rising sun, two of them went much too far to the north of east, while the third party, Kara Sai men, speedily returned, their excuse being that they did not think any one else had been before them, an excuse which they did not appear to be in the least ashamed of giving.

Thinking that from the peaks near Aksu, on the west branch of the Keria river, some of those in the Kuen Lun range or in the west of the Aksai Chin, which had been fixed by the Survey of India, would be visible, I began triangulation there, and thence worked backwards to south of the Shor Kul, only to find but the scantiest supply of burtza.

Compelled to retreat from this part, I tried a route which one of my men assured me was feasible, and led to a lake he remembered having gone to with Pike and me in 1896. This, however, proved to be worse than the first, as after a few miles east of my most easterly camp, approximate long. 82° 35′ E., not even burtza grew, while for fully two marches south there was not a vestige of any kind of vegetation to be seen; so I returned once more to Yepal Ungur, on the Keria river.

This river has four principal tributaries—the two westerly ones, that by Aksu, and another east of that place being larger than the easterly ones, except that nearest to Yepal Ungur, which for a short time in the summer is fed by the melting snow on the very high range on the right bank of the Keria river. This extensive range of snow-capped mountains, in which there are some magnificent peaks rising to fully 23,000 feet, extends from about long. 82° 30′ E. to 81° 30′ E., and there becomes lower and lower, gradually dying away west of Yeshil Kul. The range on the opposite side of the valley of the Keria river does not boast of more than a couple of snow-peaks until Iksu is reached, west of which every peak is covered with snow, and all the valleys filled with glaciers.

Not far distant from the pass north of Togral Onpo is a singularly extensive and rounded snow-capped mountain, to which Pike and I gave the name "Mount Cumulus," owing to having mistaken it in 1896 for a cloud of that name, when first seen from near Horpa or Gurmen Cho. At this point the range changes direction, its general direction being now almost due west as far as 81°, where there is a very fine double peak, the most westerly point being 23,490 feet high.

After leaving the valley of the Keria river, I went *viâ* the north side of Yeshil Kul to camp 15 of 1896, for the purpose of extending the triangulation done in 1896 eastwards and northwards. This place not admitting of sufficiently long bases in the required direction, I moved camp a short distance in an easterly direction, and measured bases of over 7 miles in length. Favoured by fine but very windy weather at this camp, I obtained most extensive views in all directions, including the high snow-range south of Horpa Cho, that on the right bank of the Keria river, and that in the middle of the Aksai Chin. By about 11 a.m. each day at this camp, the prevailing westerly wind became so strong that it was necessary to securely tie the legs of the theodolite to heavy stones to prevent it being blown over, which made the task of observing and recording by no means a pleasant one. Having accomplished my task, I returned to Baba Hatun, and connected the triangulation done previously at Aksu and elsewhere with that of 1896.

Within a few hundred yards of my camp at Aksu, the Amban of Keria established a temporary post, apparently for the purpose of making it plain to me that the Aksai Chin, at least the part I was in, was under his jurisdiction. The season was now well advanced, the minimum thermometer having fallen to −9° Fahr. during the night of

September 20; the solar radiation thermometer, black bulb, registered 106° the following day at the same place, and as the supply of grain was now very low, I turned west to Ulugh Kul. After crossing a low and very easy pass a few miles south of this salt lake, I came to the upper waters and sources of the Khotan Daria, the latter being in lat. 35° 35′ N. and approximate long. 81° 40′ E.

The first intimation I had of the proximity to Ulugh Kul of the sources of this river was from two shikaris who had just returned from the Khotan river, where they go annually in search of yak. This was corroborated by two other shikaris whom my caravan bashi met close to it. The latter party stated that they are well acquainted with the upper waters of this river, and informed the bashi that, owing to the narrow and deep nature of the valley about half a march west of where I camped, it is not possible to take a caravan down it, to where there are two or three places frequented every summer by those who earn a poor existence by digging for gold.

My supplies not admitting of my testing the statement as to the impracticability of the Khotan Daria valley, I returned to Ulugh Kul, and thence along the south of the lake, and two other small lakes, to At To (horse's back) pass, at the top of the Polu gorge. Being anxious to endeavour to carry on triangulation to Polu, I halted close to the summit of this pass for a day in quite the most dreary place that fate has compelled me to camp in. Not a vestige of vegetation is to be found within several miles of this inhospitable spot, and not even enough dung to boil a cupful of water; but fortunately the water-supply was just sufficient. A few donkey-loads of bhusa and a little corn brought from Polu enabled me to keep the few animals requisite for carrying the tents, instruments, etc., till the work was finished.

I fear that the time spent close to the At To pass was time wasted, as, owing to the very steep and narrow nature of the valley north of this pass, and its precipitous sides, there is but a very poor chance of seeing from the plateau above Polu, any of the peaks observed from near the At To pass. Unfortunately, the weather changed the day after Polu was reached, and it was not possible, except for a few hours, to see the fine peaks, now quite white, of the Kuen Lun range. The most striking meteorological circumstances were the absence of any very strong or prevailing wind north of the very high range on the right bank of the Keria river, and the registering of 20° of frost on the night of July 25. The great scarcity of game and the ample evidence forthcoming as to the roving habits of the yak were very noticeable, but I must confess to a considerable amount of surprise at seeing a yak approach my camp near the At To pass, miles away from all vegetation.

A noteworthy feature was the discovery of a large and deep—at least 12 feet—bed of dried weeds, similar to those found round some of the lakes visited by Pike and myself in 1896, at an approximate altitude of about 17,500 feet, far away from any lake or trace of one, and on the low hills of the left bank of the Keria river.

The topographical work was done by a sub-surveyor of the Survey of India, under my supervision.

SVEN HEDIN AND DUTREUIL DE RHINS IN CENTRAL ASIA.*

By Colonel Sir T. H. HOLDICH, K.C.I.E., C.B., R.E.

Among late works of travel, Dr. Sven Hedin's book stands pre-eminent as an exposition of scientific geography. Never was a book of this sort so welcome as at present. We have had more than enough lately of geography which is not scientific, and of popular works of travel which have added no really valuable addition to our map information; neither have they assisted to unravel any of the ethnographical riddles with which Asia and Africa abound. The unexplored spaces in High Asia are narrowing year by year, and with so much good geographical material as exists already, we want more exact information and more accurate observation to improve the old work, and fill in the new. In traversing Central Asia Sven Hedin departed from the usual Asiatic programme of exploration, and did not make Lhasa an objective. That city, which is still enveloped in a halo of most undeserved romance, has been visited often enough by Europeans to destroy the illusions which are usually draped around it, and, although there is certainly much yet to be learned about its quaint political institutions and weird customs, our knowledge can hardly be improved by any process short of actual residence within its walls; and of this there seems little chance at present. Lhasa was visited early in the last century by Desideri, who lived in the city for thirteen years; and by Della Penna, who was for some time there with Desideri. Then followed the Dutchman Van der Putte, who was so afraid of the reception that his Lhasa records might receive in Europe, that he destroyed them. In 1811, Mannering was sent on a political and commercial mission from India; and in 1845 the two devoted Jesuit missionaries, Huc and Gabet, were well received there. For more than fifty years no European has seen the inside of that city, although the native employés of the Indian Survey, the Pundit Nain Sing, Krishna, and the Lama Unguen (who accompanied Chandra Das) have all contributed to give us a fairly accurate account of it. Such persevering travellers as Bower, Littledale, and Bonvalot have all been refused admission, even to the neighbourhood of the sacred city; and now we have Grenard's story of De Rhins' failure. Sven Hedin wisely avoided Lhasa, and devoted his remarkable energies to investigating the phenomena which surround the natural features of Central Asian geography, dividing his explorations between the elevated tableland which lies between the Kuen Luen mountains and the Himalaya, and the great central depression which forms the Tarim basin. Unlike the majority of explorers, Sven Hedin spent several years in the attentive study of the works of preceding travellers, and even took a trial trip in order to determine the best methods of proceeding. Backed by the cordial support of the King of Sweden, well supplied with funds, possessing a remarkable faculty for picking up new languages as well as for expressing himself in old ones; gifted with the eye of an artist, and the constitution of an athlete, and blessed, moreover, with that happy spirit of universal good fellowship which makes a man equally welcome in the court or the camp, it is, after all, small wonder that he succeeded in penetrating to regions untraversed before, and that he has unearthed the long-buried secrets of a forgotten phase of Asiatic civilization.

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* 'Through Asia,' by Sven Hedin. 2 vols. Methuen.—'Dutreuil de Rhins, Mission Scientifique dans la Haute Asie, 1890–95.' 2 vols. Paris: Leroux.

In April, 1894, Sven Hedin left the Russian outpost of Fort Pamir, on the Murghab river, and by the middle of the month found himself at the foot of the Mustagh Ata—a mountain which dominates that meridional chain which we now call the Kashgar range, running parallel to, and east of, the great Sarikol watershed which divides the drainage of the Oxus from that of the Lob Nor lake regions. There has always been a peculiar fascination about the great "Ice father," the Mustagh Ata. It claims to be the highest mountain existing north of the Himalaya; it was observed by Trotter, who accompanied the Forsyth mission to Yarkand, and its height determined from trigonometrical deductions to be 25,300 feet. Trotter named the peak Tagharma, from the plain at its foot, which is called by that name. There is, however, some doubt surrounding Trotter's determinations, from the fact that another high peak to the north of Mustagh Ata would almost certainly interfere with observations taken so far to the north-east as his base near Kashgar, and consequently it is not safe to assume that there is any peak in the range so high as 25,000 feet. At any rate, Sven Hedin's Mustagh Ata is an unmistakable feature when observed from the south-west. Its magnificent dome-shaped crest and flanking pinnacles identify it beyond possibility of error, and its position has been fixed now in direct connection with the Indian triangulation. Its height was determined by Colonel Wahab (working with the Pamir Boundary Commission) at 23,500 feet. This is, however, quite high enough. There is no really satisfactory record of any traveller ever reaching so great a height. It is not surprising that in April Sven Hedin failed in his "intention to climb to the summit of the mountain, examine its geological structure, its coat of ice mail, and the gigantic glaciers which plough their slow way down its rugged side," and that he was temporarily "compelled to return, with strength broken and eyes bandaged, to seek a warmer climate." But he returned to the attack in August, and during a second and third attempt he carried out at least the best part of his programme. He did not reach the summit, but he has added a store of information about the construction and movement of the Mustagh Ata glaciers which cannot fail to be of great scientific value. And we may draw attention, not only to the minute and painstaking accuracy of his observations, but to the completeness of his series of illustrations. They are clever, artistic, and admirably clear.

Then followed his adventurous journey across the desert between the Yarkand and the Khotan darya—the two great affluents of the Tarim river, which loses itself in Lob Nor; and this part of his story contains a moral. It is a good illustration of the terrible misadventures which may befall even the most careful traveller who trusts to *conjectural maps and native information.* No sensational travelling tale that ever was written can exceed the absorbing interest of this narrative of a fight against the forces of nature—sand-hills and sand-storms, and the agonies of thirst. Sven Hedin lost two of his scanty following in the desert, and he would probably have lost a third, had he not been able to reach water himself, and carry a supply back in his boots for the relief of his last attendant. He lost camels and instruments, but his records were preserved by a second faithful follower, who finally struggled into safety; and there is nothing more remarkable in the book than the care with which the daily narrative of that ghastly period was sustained throughout—up to the very last day of it.

But the most interesting, as well as the most valuable, result of Sven Hedin's explorations was the discovery of two sand-buried cities in the Takla Makan desert. The movement of the enormous sand-dunes, or sand-waves, across open desert spaces which are subject to the terrific violence of periodic wind-storms, may not inaptly be compared to that of the sea, though the actual wave-motion is, of course, very dissimilar. Successive billows and troughs are formed, which are subject to perpetual change under the influence of wind. The gradual process of sand encroachment can be observed in the Takla Makan desert (as in the Oxus regions) by the desiccated remains of forest and vegetation in the neighbourhood of rivers. The rivers themselves are gradually being pushed eastwards, and the riverain tracts become slowly enveloped. Towns and cities which were once within reach of irrigation are lost in the sand encroachment, and as the successive waves traverse their sites they are occasionally brought to light in the troughs of the sand ocean, again to be overwhelmed by the next following wave. Sven Hedin was fortunate enough to light on two cities thus exposed to view; and nothing can be more interesting than his description of the relics which he rescued from them, which point conclusively to the existence of these cities as great Buddhist centres in ancient times. The more recent of them, which is about 120 miles north-east of Khotan, and (apparently) not 20 miles from the southern edge of the desert, may have existed when the Chinese pilgrims of the early centuries of our era made their religious pilgrimages through Asia. Sven Hedin thinks that Takla may be the Tu-ho-lo of the Chinese, and that the Tukhari inhabitants were a people (possibly of Tibetan origin) who migrated westward, and founded the kingdom of Tokharistan. His observations of the direction and nature of the sand encroachments that are gradually drifting to the south-west, lead him to assign a period of about two thousand years from the time of the cities' disappearance to the present limits of desert formation. The Buddhist figures and paintings which he recovered in a marvellous state of preservation, do not differ materially from those which are found in the Peshawur valley, and which belong to a period anterior to the ruthless invasions of Mahmud of Ghazni. Greek influence in design is very perceptible in all of them.

The second city, which he unearthed when following the course of the Keria river, appears to be of about the same date, though very much farther removed from the southern edge of the desert. All this part of Asia was so devastated by the Arabs in the early part of the eighth century, when the faith of Islam was forced on the population, and subsequently so cruelly given over to destruction by Chenghiz Khan in the early part of the tenth century, that it is not likely that anything in the shape of ancient building structure will ever be found to connect the modern city of Khotan with the buried city of the desert. The site of Khotan is probably as ancient as any of them, but the city itself is modern. Sven Hedin secured an interesting relic of certain ancient Christian communities at Khotan, which must have been directly connected with the Nestorian and Jacobite sects whom Marco Polo mentions as existing at Yarkand and Kashgar. As early as the fifth and sixth centuries A.D., there were Christian bishoprics at Herat, Merve, and Samarkand, later at Yarkand, and finally in China. That at Yarkand is believed to have existed in the fourteenth century. The last Gurkhan of the Kara Kitay empire, the legendary Prester John, was a member of a Christian Kirghiz tribe called Naiman, which tribe is well known on the Pamirs to this day. Chenghiz Khan himself, though he hunted down and destroyed Prester John, is said to have married a Christian wife. Survivals of ancient Christian ritual are still to be found amongst the Sarikolis and certain Kirghiz tribes, especially in connection with their marriage customs.*

Sven Hedin's mapping of Lob Nor, the terminal lake region of the Tarim river system, is one of the most valuable of modern additions to the geography of Central Asia. He shows conclusively that this is a region of perpetual change, and that there have been extensive modifications of the lake outline even since the days of Prjevalsky. On the whole he finds the lake system (for there are many lakes) to be very much where Chinese geographers place it. The altitude of this central depression he marks as only 2500 feet above sea-level.

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* *Vide* 'Pamir Boundary Commission Report.'

Through the waste, uninhabited regions of Northern Tibet, amongst wild yaks and "kulans" and uncouth Mongolian nomads, Sven Hedin's story takes the reader to China. From his start at Keria, south of the Takla Makan desert, past the great blue lake of Koko Nor, to his first European greeting with the young American lady doctor in Chinese dress and spectacles, who welcomed him at Tenkar, the whole story is fascinating—but we cannot follow it further. Dr. Sven Hedin sums up the extent of his travels as covering a distance rather more than from the north to the south pole. When we think of the wealth of minute scientific observation that was acquired during that extent of travel, and note the traveller's keen interest in the ever-varying phenomena of nature, as well as in the idiosyncrasies of the uncultivated humanity that he met with on his way, we cannot feel surprised that two fairly large volumes should fail to complete his record, and that we must look for a further instalment of scientific notes to round off the full results of his monumental expedition.

M. Dutreuil de Rhins commenced his explorations in Central Asia by adopting Khotan as a base, similarly to Sven Hedin, whom he preceded. The year 1891 was occupied in a tour to the south-east, when he visited Polour (Polu of Sven Hedin's map), and traced the course of the upper Keria, through the deep gorges which carry it from Polu to the plains. He visited Nia (described by Sven Hedin), and returned to winter at Khotan.

In 1892 he again traversed the road to Polu, followed up the Keria river to its source, and then struck south-west by Yeshil Kul into the lake region to the north-east of Ladak. The difficulties and hardships of travel in the mountain regions south of Polu told so severely upon his health, that it is hard to understand, from M. Grenard's description, how it was possible for him to proceed at all. Proceed he did, however, and after traversing an almost unknown region east of Ladak, he finally reached Leh, from whence he followed the Karakorum route back to Yarkand. Although he was working in regions not very remote from Indian survey, he was on comparatively new ground, and this expedition should add much to our topography of Western Tibet, although not much is perceptible in the very small-scale maps which illustrate the book.

Want of resources, combined with ill health, had so far prevented De Rhins from carrying out the full programme which he had laid down for himself at starting. But he was in no ways discouraged, and he succeeded in obtaining more substantial support for his next attempt at traversing Tibet in 1893. It is interesting to observe that about this period the author of the book encountered an old Chinese friend, one T'ien, at Yangi Hissar. T'ien had been decorated with the "blue button" for the success of his negotiations with "Colonel Mortimer Durand" at Gilgit, and claimed to have obtained great concessions for China. Final arrangements for further exploration were not complete till July, at Cherchen, whence De Rhins and Grenard made their start southward for Lhasa.

From Cherchen they followed a route, which carried them to the head of the Kara Muren river, the upper branches of which are shown by their maps to be considerably south of the position assigned to them by Sven Hedin. In September they crossed the Arka Tagh by a pass about 60 miles west of Sven Hedin's, and apparently much easier. The head of the Kara Muren leads directly to it. As they had sixty-one baggage animals with them, including camels, it must be, for Tibet, a comparatively easy pass. From the Arka Tagh they travelled almost due south through an absolutely unmapped and unexplored region, until they struck Bower's route to Lhasa in about lat. 33° N. So far they had traversed an elevated lake region with all the dreary characteristics of the uninhabited wastes of High Tibet, crossing the general strike of the plateau ranges, and discovering many small lakes, of which they counted sixteen before turning eastward. This eastward turn was taken from lake 16 (which is one of those mapped by Bower), and it carried them, during the month of November, in an east-south-east direction past four great lakes before reaching the Namtso, or Tengri Nor. Bower's route lay to the north of these lakes, touching their northern shores. De Rhins passed them on the south. From Gyaringtso to Tengri Nor they were approximately on Littledale's route, but they formed their final camp for entering into negotiations with the Lhasa authorities at the eastern end of the lake. Littledale penetrated further, and reached the watershed between the Tengri Nor and the Sangpo (the river of Lhasa) from the western side. There is, however, not much to choose between them. They were equally unsuccessful in overcoming the prejudices of the Tibetan authorities, and, although negotiations appear to have been conducted courteously and in a friendly spirit, there was finally no alternative for the French explorers but to take a northerly route again to the Chinese border, and to leave Lhasa unvisited. Half of the baggage animals had been lost in the journey to Tengri Nor, and it was necessary to refit before starting, so that it was not till January that they were again on the road. The Chinese frontier town of Sining had now become their objective, and between it and Lhasa is a much-traversed and well-known trade route. But a route which had already been exploited by several travellers did not meet De Rhins' approval, and he decided on following the road which leads *viá* Nagchu to Gye-rgoundo (Jyekundo) to Sining. Having first established connection with Bonvalot's routes at Larkang, south-east of Tengri Nor, the two

Frenchmen quitted their camp at Zamna (? Dakmar) on January 19, for Nagchu.

From Nagchu the road to Jyekundo diverts eastwards from the regular Sining trade route, and passes through a mountainous country which encloses the headwaters and sources of the Mekong and Dichu, or Yangtse Kiang. It was not till the end of May that they reached Gye-rgoun-do (the English spelling of which is Jyekundo), and here they met with a very doubtful reception. In fact, there were unmistakable signs of hostility on the part of the authorities. Two marches from this place, along an unfrequented route, for which no guide was forthcoming, De Rhins met his fate. They had reached a village called Tong-bou-mdo (English spelling, Tambudia), and experienced an openly hostile reception on the part of the people. It was unfortunate that at such a juncture De Rhins should have been led into an act of retaliation for the loss of two of his baggage-ponies, which were stolen during the night. He seized the first two that came to hand, and impressed them into his service. Possibly the effects of hard work and exposure in a frame already much enfeebled by pain and sickness had told upon him, and dimmed his perceptions of the urgent necessity for that "equal mind" which Horace tells us we should be specially mindful to preserve in face of adversity; for we read previously, that at Jyekundo he had threatened to pull the ears of the chief official in the town if his wishes and demands were not complied with. Anyhow, the end soon came. The caravan was attacked, and De Rhins was mortally wounded by a Tibetan bullet before they had proceeded far from the village. There can be little doubt, from M. Grenard's account, that the attack was organized by the village authorities, and countenanced by the officials at Jyekundo. After De Rhins fell, the party was broken up and scattered, and it appears that De Rhins, alive or dead, was thrown into a small affluent of the Dichu river. M. Grenard escaped with difficulty into Chinese territory. This happened in June, 1894, and the news reached Sven Hedin the following January. On arrival at Sining, Sven Hedin was shown, amongst other curiosities, the skull of De Rhins' murderer, but it must be extremely doubtful if the individual who fired the fatal shot was ever identified.

The most important of the geographical results of the journeys of this adventurous Frenchman is the new light thrown on the physiography of the elevated lacustrine regions of Tibet to the north-east of Ladak. We have now three routes traversing the high mountainous tableland which lies south of the central depressions of the Tarim basin, from north to south. De Rhins, Littledale, and Bonvalot have all crossed that plateau on lines which are approximately parallel; and, thanks to Sven Hedin's observations, and the care taken by M. Grenard to bring De Rhins' route to a connection with that of Bonvalot, we shall probably have a better basis for reconstructing the general map of that part of Tibet that we have ever yet possessed. The maps illustrative of M. Grenard's book are on far too small a scale to admit of any comparative method of testing the results of his work. It would appear, however, that the greatest difference shown in absolute position of any point, between his mapping and Sven Hedin's, is at the starting-point, Cherchen, where there is an apparent difference of some 8 or 10 miles in longitude. His position of the great chain of lakes north-west of Lhasa seems to accord fairly well with Bower's; and he has illustrated the geography of the country immediately to the north-east of Tengri Nor in a manner which no previous traveller has attempted. The final results of his map compilation cannot fail to be very valuable. The book is written in a style which renders every page of it interesting. Too often the deadly monotony of Tibetan travel is reflected more or less in the pages of the travellers who tell the tale of it. This is not the case with M. Grenard's story; and the illustrations of the work (especially the reproduction of photographs) are as perfect as only French artists can make them.

VOYAGES OF THE ZENI. *

By C. RAYMOND BEAZLEY, M.A.

THIS book (in writing which Mr. Lucas has enjoyed the valuable advice of Mr. C. H. Coote and Mr. Miller Christy) is unquestionably and by far the best study of the Zeno question that has yet appeared. At the same time it must not be forgotten that Dr. Gustav Storm is the Continental protagonist of the critical indictment against the Zeno stories, and that the case, which may now be considered triumphant, was first presented by that eminent Norse scholar in his 'Om Zeniernes Reiser' and 'Claudius Clavus' (1891). Admiral Zarhtmann, indeed, had, as early as 1833, subjected the Zeno narrative to a very disquieting examination in his 'Bemærkninger om de Venezianerne Zeni'; but Major in 1873 ('Voyages of the Zeni'), Desimoni in 1878 and 1885 ('Memoria interno ai viaggi dei ratelli Zeno' and 'Viaggie carta dei fratelli Zeno'), with others, made a brave attempt to rehabilitate the disputed tradition, and for some time arrested its decay. Thus John Fiske, as late as 1892, considered that Major's "heavy strokes" had so "completely demolished" Zarhtmann's objections that not enough was left to pick up ('Discovery of America,' vol. i. p. 237). Fiske had not read Storm's already published studies, or he would not have committed himself to this unfortunate piece of rhetoric, or to the still more unlucky outburst that follows ("as

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* 'The Annals of the Voyages of the brothers Nicolo and Antonio Zeno in the North Atlantic about the end of the fourteenth century, and the claim founded thereon to a Venetian discovery of America: A criticism and an indictment.' By F. W. Lucas. London: Henry Stevens, Son, & Stiles. 1898.

to this . . . we may . . . safely cry, *Finis, laus Deo*"), for in 1891 matters were already desperate with the Zeno story as a whole. The more important features of Dr. Storm's work are now represented to the English reader by this splendid volume of Mr. Lucas; but the latter's work is far more than a reproduction of any earlier book on this subject. The Zeno controversy was never before presented in so ample a manner, and with so many and pertinent illustrations.

The present indictment falls into five parts: (1) The story of the book related, pp. 1–56; (2) the story of the book considered, pp. 57–139; (3) summary and conclusions, pp. 143–157; (4) appendices and index; (5) atlas of maps. Among the appendices we have, *e.g.*, facsimiles of the Zeno narrative from the original edition of 1558, and from Hakluyt's 'Divers Voyages' of 1582; a comparison of the names on the Zeno map with their correspondencies on fifteen other cartographical works, from the Bianco of 1448 to Ruscelli's 'Ptolemy' of 1561; a table of Zenian identifications by the leading defenders of Zenian genuineness, in whole or part, from Reinhold Forster to Steenstrup (1784–1884); and a chronological list of the principal authorities. Among the maps are portions of Fra Mauro (1457–9), the Zamoiski map of circa 1467, the Olaus Magnus of 1539, the Mercator of 1554 and 1569, the Tramezini map of 1558, the Lafreri of the same year, the Ruscelli edition of Ptolemy (1561), and the Ortelius of 1570. The original Zeno map occurs at Plate XI. in this atlas, which is supplemented by several important illustrations in the body of the text. This volume, it must be said, is a credit, not only to Mr. Lucas, but to the Chiswick Press, and is one of the handsomest geographical books published recently.

Assuming that Mr. Lucas's general conclusions are, with our present lights, final, it may perhaps be thought that a little more allowance should have been made for a possible basis of fact in the European part of the narrative. All pretensions to an American discovery are, as suggested here, quite untenable; but it may be fair to enlarge slightly the first conclusion on p. 156, and to say, not only that Nicolo and Antonio Zeno "may have" sailed into the North sea, visited the continental Frisland, and written letters to Venice during their travels, but that they probably did so; that such letters may have survived into the sixteenth century; and that these may have been used in the compilation of the 'Annals.' It may also be thought that in Zeno's Frisland there is a genuine reminiscence of Iceland, and of Shetland in his "Estlanda," and that the travellers Nicolo and Antonio did really voyage to these islands, as well as the Färoes, in the last years of the fourteenth century. A little more also might have been made of some of the excuses well stated on pp. 144, 145, *e.g.* that the errors of the text are partly due to the misreadings of the compiler, and that, mixed with exaggeration and falsehood, there are many things in the story which are true in themselves, though distorted by the ignorance of the historian.

A certain ruthlessness of temper appears at times to drive Mr. Lucas, as it drives Mr. Harrisse, into a more absolute denial than is necessary or advisable; but for this such a defence as Major's is largely responsible. The last-named scholar rendered great services to geography in his time, and can never be mentioned except with respect; but in the Zeno controversy his almost aggressive attitude of belief was quite out of place. He also made several mistakes in detail, which are difficult to understand, and which are noticed, perhaps with somewhat too severe a pen, by Mr. Lucas. He repudiates, as an insinuation against "Zeno's excellent Greenlandic geography," Zarhtmann's suggestion that the (then lost) Olaus Magnus of 1539 might have served as a basis for the Zeno map. This and similar dogmatism against Zarhtmann's "old manuscript map" at Copenhagen broke down completely with the re-discovery of the very Olaus in question (1886) of the Zamoiski map (1888), and of the three "Florentine" designs reproduced by Nordenskjöld in his 'Bidrag till Nordens . . . Kartographie' (1892). The important correction of the date from 1380 to 1390 Major wrongly attributes to Hakluyt, who was only following Ortelius. The name identifications given in certain places by Zeno's apologist are greatly ridiculed—often with reason—by Mr. Lucas (pp. 69, 70); but some of them are matters of opinion, and perhaps not so impossible. Corruptions almost equal to those of the Zenian nomenclature are surely to be found in some genuine records. On pp. 68, 70, 73, 87, 90, 94, 95, 97, 99, 119, Mr. Lucas gives other and better instances of Major at fault, but they need not be noticed here, except his extraordinary inconsistency as to "Icaria," Kerry, and Ireland (p. 70, note, etc.).

Past methods of Zenian apologists are therefore, no doubt, responsible for the occasional hardness of Mr. Lucas's indictment. Otherwise, he would perhaps have more freely admitted (pp. 4, 5) that the genuine Persian travels of Caterino Zeno, which accompany the northern travels of Nicolo and Antonio, and like them have lost their original documents, give some colour to the latter, and suggest that even these contain a residuum of truth, however much compromised by "American pretensions" without any support in fact. On pp. 46 and 61 of the present volume, rather too much seems made of the destruction of the date-coincidence argument bearing upon the identification of "Sinclair" and "Zichmni," unless it is implied that Sinclair was no longer living in 1390, at the real time of Nicolo Zeno's first visit. Also (on p. 73) the words "ignorance or impudence" seem excessive for a merely conjectural liberty of Nicolo the younger; the same may be said of the term "apocryphal" (p. 68) for Ferdinand Columbus 'Historie' or 'Life of the Admiral,' whose genuineness can hardly be considered as in all respects disproved. Harrisse himself does not, Mr. Lucas admits, absolutely reject the very passage as to "Frisland" which is responsible for the word "apocryphal" in this connection.

The canon suggested, on pp. 87, 88, viz. that "one piece of fable" can taint a whole story with suspicion, is one that occasionally leads to over-criticism; the literature of Sebastian Cabot and Ferdinand Mendez Pinto is evidence of this, and Mr. Lucas perhaps overstates the gullability of the reading public. The wish to give even the strangest stories a fair hearing is not to be confounded with mere credulity; and the advance of science has been certainly due to "convincability" as well as to scepticism. May we add that we should have been glad of a more complete reply to De Costa's palæographical argument for Bordone's acquaintance with the Zeno map as early as 1521 (pp. 102, 103, mentioned with respect, but ignored on p. 104); that "Icaria" (pp. 89, 120, 121, etc.), if identical with Olaus' "Tile," has perhaps closer reference to "Tillemark," in Norway (one original for "Thule"), than to St. Kilda; that the identification of "Estotiland" with "Escociland," or Scotland, may appear to some more plausible than its suggested connection with the motto, "*Esto fidelis usque ad mortem*;" and that the Venetian relics said to have been brought back from the north by the Corterfal expedition in 1501, are possibly worth more than Mr. Lucas will allow—not, necessarily, as evidence of a Zeno voyage to the New World, but in other respects. It might have been well if more references from the "original accounts of Columbus" and others, containing the materials of Zeno's descriptions, had been given, as well as or even instead of the extracts (on pp. 81, 83) from Bordone's 'Isolario,' valuable as that is as an intermediary. Why should not the name *Drogeo* be a corruption for another "Boca del Drago," or Magellan's Straits (*Cola do Dragam* in Galvano, 'Discoveries of the World,' under A.D. 1428)? The identification of *Sinclair* with *Zichmni* is certainly very doubtful,* but has Mr. Lucas, in the pursuit of his very skilful argument for the pirate Wichmann as the missing link, made quite enough allowance for the intermediate forms *Zicno* or *Zinco* (pp. 45, 46, 54, 61, 93, 94, 96)? Can the *Terra de Lavoratore* of Bordone be fixed as exclusively Greenland and nothing else (p. 39)? Is it not rather a compound, like Henry Hudson's "Greenland," which is our Spitsbergen? The "Andrea Bianco" map of 1436 (referred to on pp. 105, 106, etc.) is probably only Bianco's re-edition of a thirteenth-century work, and should not be attributed to him except as editor or publisher. Prof. Gaffarel's conclusion (quoted on p. 152) is challenged; but the French scholar might still deny that Zeno "avait cherché a décrier Colomb et voulu le présenter comme le plagiaire des Zeni," as no one pretended that Columbus had ever seen the Zeno narrative, unpublished and unknown to the world at large, according to its own defenders, till 1558. Perhaps too much is made of the omission of personal names (pp. 154, 155); and the identification of St. Brandan's isle (as to which the mythical element is overpoweringly strong) with St. Kilda is open to many objections. Lastly, why is Benjamin of Tudela (p. 147) classed with such fable-mongers as Sir John Maudeville and Psalmanazaar? Is not Benjamin fairly reliable as far as Bagdad?

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* He is justly sarcastic (p. 97) on the enthusiasm of a writer who, as late as 1894, claimed that "Henry [Sinclair] was the one and only discoverer of America, destined to bulk more and more largely to future Americans as their typical hero primæval." Mr. Miller Christy, I may say, does not feel sure that the Zeno map contains anything necessarily fraudulent. He draws attention to the very erroneous latitudes as a cause of shortcomings; also to the over-northerly position and comparatively correct shape of Greenland, both features observable in several other fifteenth-century maps, but not common in the cartography of the mid-sixteenth century. Also the names of the Zeno map are taken, though in a corrupted form, not from works of the sixteenth century, but from earlier books and charts. These suggestions go to strengthen the belief that there may have been, in the possession of the younger Nicolo Zeno, a rotten old map, such as he describes, of about the reputed date of the voyages in question. If Zeno had been concocting a purely fraudulent map, would he not have been likely to introduce some more recognizable features from the cartography of his own time?

On the other hand, though the Zeno book has certainly produced a literature out of proportion to its importance (see p. 56), one is almost glad of the controversy when it results in a work so thorough and so far-reaching as this, one which will repay the most minute study, and is far more than it professes to be. For it is not only an indictment of a famous geographical legend; it is a valuable treatise for the history of discovery and cartography in the later middle ages. Especially admirable is the treatment of the Zeno map and its sources—the "Zamoiski," "Claudius Clavus," "Florentine," "Olaus Magnus," and others (pp. 99–124), and the exposure of the inconsistencies between this map and its accompanying text (p. 69, etc.); some of the reproductions, however, might have been clearer, *e.g.* that of a part of the "Catalan Atlas," on p. 107, or the Portolano and extract facing p. 111. The influence of Mercator and Ortelius in the history of this controversy is excellently stated; and so is the case for Iceland as an original of Zeno's "Frisland" (pp. 116, 117). The history of the latter name, in its various forms, is also very well discussed (on pp. 105, etc.); and the Zeno narrative is pointedly illustrated by Mr. Lucas' reference to the sufferings of the Icelanders in the fourteenth and fifteenth centuries at the hands of English and other filibusters or "fishermen" (p. 72).

In the Zeno controversy, as in so many others, political and racial prejudice has been deplorably prominent. A good instance of this is quoted (pp. 30, 31) from the diary of Dr. John Dee, when on November 28, 1577, he "declared to the Queen her title to Greenland, Estotiland, and Friseland;" and on June 30, 1578, told Hakluyt "of the Middle Temple" and others how "King Arthur and King Maty, both of them, did conquer Gelindia, lately called Friseland." The same prepossessions appear more mildly in Hakluyt and Zurla, more violently in Terra Rossa and "Caithness Events." Such a spirit has long been recognized as one of the worst obstacles to historical science; it is a regrettable instance of the vitality of prejudice that hardly a single Italian writer has openly rejected even the American pretensions of the Zeni.

RATZEL'S 'POLITICAL GEOGRAPHY.'*

PROF. RATZEL has done a service for which geographical students will be grateful, by bringing together for the first time in systematic form the data and problems with which political geography has to deal. The subject, as hitherto treated in our text-books, has been the driest and most unprofitable of all tasks. It was from this barren presentation of the subject that the general conception of "geography" was obtained, and it is no wonder that serious educationists treated it with contempt, and that it was despised and rejected at our universities. Our Society has had a hard struggle in its endeavour to show that this prevailing conception of geography was completely inadequate and unwarranted, and that when dealt with as it might be, and as it is in Germany, it was worthy even of a place in the university. Happily, the Society's efforts have met with a great measure of success, and with Prof. Ratzel's elaborate treatise of about 700 pages at our command, it may be shown that even the hitherto despised "Political Geography" may be made a study full of human interest, worthy of the serious attention of statesmen, political economists, and historians. As Prof. Ratzel points out, the "State" is often treated as if it were "in the air," and had no connection with the land on which communities live and move and have their being. Yet long ago Ritter showed the intimate relations which exist between humanity and the geographical stage on which it plays its part. With even more point and profundity Peschel did the same, though in a somewhat fragmentary way. Prof. Ratzel's 'Anthropogeography' may be regarded as a more systematic attempt to show the general relations between man and his geographical environment. Both in Germany and in France this line of investigation is being now carried out in detail, so that what may be called the literature of anthropogeography is assuming considerable dimensions.

In our estimation, anthropogeography is a convenient term under which to include all those aspects of geography that deal with the relations of humanity as a whole or divided into communities to the earth, with which alone physical geography has to deal. "Applied Geography" might be taken as an alternative term, though on the whole it has a wider scope. "Political Geography" may be regarded as a subdivision or special application of anthropogeography, and therefore Prof. Ratzel's latest work is a natural sequel to that on the more general subject. In 1881, Bluntschli, in referring to Ritter, pointed out what marked progress had taken place since his time in our knowledge of the physical geography of the land, and insisted that "a comprehensive and fundamental investigation into the influence of the physiognomy of the land on humanity would be of immense benefit to political science." Since 1881 progress in geographical research has made vast strides, so that ample material exists for the formidable task which Prof. Ratzel has so successfully completed. He has approached the subject from the purely geographical standpoint, and has adhered to that standpoint throughout. He points out that a "state," which may be anything from a tribe of nomads to a "Great Power," is inconceivable without a more or less extensive area of land on which to exercise its activities. Land and people in a political community are indissoluble; the one is as essential to its existence as the other. This may be taken as the text of Prof. Ratzel's treatise, and, standing firmly on the land, he considers systematically the various relations that exist between the two, and the influence which they exert on each other. Prof. Ratzel has faced the subject boldly and unflinchingly, and his book may be commended to the study of all serious students of geography. Naturally, in what may be regarded as a first attempt to construct a science of political geography, the author may have erred on the side of redundancy. Occasionally it looks as if he had emptied his note-book into his pages, instead of presenting us with a clean and clear statement of conclusions. But we must not expect too much from the quarryman, and we hardly consider this redundancy a fault; if it is, it is a fault in the right direction.

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* 'Politische Geographie.' Von Dr. Friedrich Ratzel. München und Leipzig. Verlag von R. Oldenbourg.

Prof. Ratzel divides his work into nine sections, each subdivided into several chapters, and, as will be seen, he follows on the whole the analytical method. In the first section he deals with the state and its territory (*Boden*). Here he works out some very interesting results from his conception of the state as an organism attached to the land, though this organic analogy may be carried too far. The "state," of course, may be a community at any stage of development, and it will often be found extremely useful to consider the mutual relation of people and territory in their more primitive forms. There is a special chapter on the relationship between territory and state, and another on the interesting point of "Possession and Dominion." The second section treats of "Historical Movement (*Bewegung*) and the Growth of the State." Many interesting problems are discussed in this section from the point of view of geography; among others, those of "Conquest and Colonization," "Political Regions" and "Natural Regions," "Spheres of Interest," "Internal Division and Union." Section III. deals with the "Fundamental Laws of the Territorial Expansion of the State," which is followed by two sections dealing with "Position" and "Dimensions." The latter term scarcely expresses the German "Der Raum," which Prof. Ratzel seems to use for the land available for political settlement and expansion, and under that head he deals with many important political problems. One of the most important sections is the sixth, which deals with "Boundaries," a subject abounding with points of interest. "Transition between Land and Sea" is the subject of the seventh section, under which the coasts, peninsulas and isthmuses, and islands are dealt with. This is followed by a section on "The World of the Water," and another on "Mountains and Plains." There are many special maps in the text, and ample references appended to each section.

This brief *résumé* may afford some idea of the richly suggestive work which every serious student of geography is bound to consult. For the sake of geographical teachers who cannot read German, it is much to be wished that some enterprising publisher would issue an English translation; he would have to do so, we fear, as a labour of love, for it is doubtful if the sale would prove remunerative, at least in the immediate future. We commend the book to the notice of the Clarendon Press.

CIVIL TIME;

OR TABLES SHOWING THE DIFFERENCES IN TIME BETWEEN THAT USED IN VARIOUS PARTS OF THE WORLD AND GREENWICH MEAN TIME.

By JOHN MILNE, F.R.S.

[*It is requested that corrections and additions to these tables may be sent to Mr. John Milne, Royal Geographical Society, Savile Row, London.*]

PREFACE.

THE greater part of the information contained in the following tables is based upon replies to a circular which, through the kindness of the Foreign, Colonial, and India Offices, was forwarded to Her Majesty's representatives in various parts of the world.

This circular is here reproduced, first, because it explains the object of the tables; secondly, because it shows the difficulty there is in obtaining the information required; and thirdly, with the hope that persons interested in the matter of time differences will forward notes on the subject, especially in connection with countries and places not included in the following list.

"British Association, Burlington House, London, W.

To ______________________

"SIR,—It is, I think, remarkable that there appears to be no publication which shows the corresponding value in Greenwich mean time, of the local time employed throughout the world.

"Such a table is indispensable in order to determine accurately the instant of occurrence of earthquakes, sea-waves, magnetic phenomena, the despatch of telegrams, and many other events, the sequence of which in absolute time has to be determined.

"Although application has been made to the Royal Observatory at Greenwich, to the Royal Geographical Society, to the Central Telegraph Office in London, to the offices of cable companies, and to other possible sources of information, very little has been obtained.

"As a secretary of the British Association Committee whose names are appended, I desire to publish in their forthcoming report a table showing the differences between Greenwich mean time as used in England and Scotland and that of the civil times used in various parts of the world.

"By civil time I mean the time used by railways, telegraphs, and for ordinary public affairs.

"If different times are used in various parts of your country, I trust that you will be able to give information relating to the same.

"Feeling assured of the value of the table it is intended to compile, I sincerely trust that you will favour me with a full and explicit statement of the time generally employed in your country. If it is mean time, state the meridian; the observatory, or the place to which this refers; and also, as a check against any misunderstanding, please state distinctly the equivalent of December 1, 9 a.m. G.M.T. in the local time, or times adopted in your own country.

"I have the honour to remain, Sir,
"Your obedient servant,
"JOHN MILNE."

Although the notes based on the replies to the above are marked O.D. (Official Document), it must not be imagined that in all cases the information they convey is absolutely correct, but simply the best, and this in many instances after great trouble, that could be obtained.

A certain number of notes marked L.T.S. are taken from a "List of Time Signals" compiled by Captain T. H. Tizard, R.N., for the use of seamen, as an aid for ascertaining the errors and rates of chronometers, and published by order of the Lords Commissioners of the Admiralty. These signals, in most instances, refer to the mean time at certain ports, and therefore do not necessarily indicate the time used in chronicling events in newspapers, by the railways and telegraphs, and by the public at such places.

Much information relating to the railway and other times used in the United States, Canada, and Mexico, was obtained through Sir Sanford Fleming, Mr. W. F. Allen, and by reference to the 'Traveller's Official Guide,' published at 24, Park Place, 19, Barclay Street, New York. For further information in connection with India, see the 'Indian Telegraph Guide,' published in Calcutta.

Notes marked I.T.B. are compiled from information furnished to the International Telegraph Bureau in response to an inquiry reproduced in the Berne notifications. For these notes I am indebted to W. H. Preece, C.B., F.R.S., who obtained the same from Mr. R. J. Mackay. Those notes which refer to differences of time used for telegraph purposes show many inconsistencies, and judgment must be exercised in their acceptance.

In the table of difference of telegraph time as used by various cable companies and that of Greenwich mean time inconsistencies again appear; but even if the various entries do not in all cases refer to the standard time of the countries to which they are annexed, so long as they have a practical application it seems desirable to record the same. A glance at this table indicates the necessity of greater uniformity, whilst a comparison of the same with the entries which precede it shows that closer approximations are desirable. For example, we find, in the list of times used by telegraph companies, Tokio and Nagasaki entered as being respectively 9h. 18m. and 8h. 40m. fast on Greenwich time. As a matter of fact, the time used throughout Japan since January, 1888, has been 9h. fast on Greenwich.

When a time difference is given to within a second or a fraction of a second, it must be remembered that such attempts at accuracy are dependent upon determinations of longitude which in themselves, for various reasons, are in most instances but rough approximations to the truth. As illustrative of the greatest accuracy with which this quantity has at present been obtained, we may refer to Madras, and for the accuracy of ordinary determinations to St. Helena.

The arrangement in the tables is alphabetical—in the first according to countries and islands, and in the second according to countries, islands, and towns. The letter F indicates that the time at a given place is "fast," or ahead of Greenwich mean time, whilst the letter S indicates that it is "slow," or behind that of Greenwich. West European time means Greenwich time. Mid or Central European time means one hour in advance of Greenwich. East European time means two hours in advance of Greenwich.

	h.	m.	s.	
ALGERIA	0	9	21 F.	I.T.B. The meridian of Paris. O.D.
ANNAM	(See COCHIN CHINA.)			
ARABIA—				
Aden	2	59	54 F.	Meridian of the saluting battery at Aden. O.D.
Muskat	3	54	24 F.	Meridian of Muskat Tidal Observatory. O.D.
Yemen	1	55	56 F.	I.T.B. Meridian of St. Sophia, Constantinople. O.D.
ARGENTINA—				
Buenos Aires	4	16	48·2 S.	This is Cordova time. This is the legal (civil) time for the whole republic, and is telegraphed each day to control the time-pieces in various cities. It is used by railway and telegraph offices, but many citizens in the provinces use a doubtful local time. O.D.
La Plata	3	51	38·95 S.	Local mean time. L.T.S.
AUSTRALIA—				
New South Wales	10	0	0 F.	Since December 22, 1894. On July 23, 1896, the Act was amended, and a time 9h. F. was applied to the municipal district of Broken Hill and the electoral district of Sturt in respect to Licensing and other Acts. O.D.
Queensland—				
Brisbane	10	0	0 F.	In the Standard Time Act of November 27, 1894, issued from the Surveyor-General's Office, Brisbane, there is a table showing the difference between the above time, which is that of the 150th meridian, and the local time of a large number of towns in Queensland. O.D.
South Australia *	9	0	0 F.	O.D.
Victoria—				
Melbourne	10	0	0 F.	O.D.
West Australia	8	0	0 F.	Since July 17, 1895. O.D.

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* A bill to repeal the Act of 1894, and make standard time 9h. 30m. F., is now (January, 1899) under consideration.

	h. m. s.	
AUSTRIA	1 0 0 F.	For railways and for telegrams handed in at railway stations; but other offices keep Vienna time, which is 1h. 5m. 21s. F. I.T.B.
BAHAMAS—		
Nassau	5 9 29·5 S.	O.D.
BAHRAIN ISLANDS	Oriental time from "sunset to sunset." O.D. See SYRIA.	
BALEARIC ISLANDS—		
Palma	0 10 32 F.	O.D.
BARBADOS	3 58 29·2 S.	O.D.
BECHUANALAND	1 30 0 F.	Regulated by the Cape Town Signal. O.D.
BELGIUM	0 0 0	Since April 29, 1892, this has been the official time. It is used by railways, telegraphs, and the marine with the twenty-four hours' system, the day commencing after midnight. O.D.
BERMUDA—		
Ireland island	4 19 18·3 S.	Meridian of the clock tower, Bermuda dockyard. O.D.
BORNEO, DUTCH	Local mean time. See JAVA.	
BOSNIA	1 0 0 F.	I.T.B.
BRAZIL—		
Rio de Janeiro	2 52 41·1 S.	Meridian of the observatory. This is used by telegraphs, state railways, and by public offices throughout the greater part of the administration. It is regulated by an electric signal sent to all telegraph stations, and to the state railway each day. In some places a local time is employed. O.D.
BULGARIA	2 0 0 F.	Mean time of Eastern Europe. I.T.B.
BURMA—		
Rangoon	6 24 40 F.	Time ball observatory at Rangoon. O.D.
CANADA—		
East coast to 67½°	4 0 0 S.	Inter-Colonial time. Nova Scotia, Prince Edward's island. The time used on the railways from Halifax to Fort William is Eastern time.
67½° to 82½°	5 0 0 S.	Eastern time. New Brunswick, Montreal, Ontario.
82½° to 97½°	6 0 0 S.	Central time. Manitoba, Kewatin. This time is used from Port Arthur and Fort William to Brandon.
97½° to 112½°	7 0 0 S.	Mountain time. Saskatchewan, Assiniboia, Alberta, Athabasca. On the railway Brandon to Donald.
112½° to west coast	8 0 0 S.	Pacific time. British Columbia.

The above times are used by railways and telegraphs. Westward from Port Arthur the twenty-four hours system is used. The time 5h. 0m. 0s. S. on Greenwich is used for railways and telegraphs from Port Arthur and

Fort William to the Atlantic coast. At St. John's (N.B.) a local mean time, 4h. 24m. 16s. S., is used, and local mean times are in use at other places. Halifax uses 4h. 0m. 0s. S. Yarmouth, N.S., has several times. For time used at Dividing Points, see UNITED STATES. O.D.

	h. m. s.	
CAPE COLONY	1 30 0 F.	Since February 8, 1892. Regulated by a time signal sent from the General Post Office, Cape Town, to all principal towns. O.D.
CAYENNE		No reply received.
CELEBES		Local mean time. See JAVA.
CEYLON—		Madras mean time used from May 1, 1898. Prior to this Colombo mean time, 5h. 4m. 21·9s. F., was used. O.D.
CHILE—		
Valparaiso	4 46 30 S.	This is telegraph time used by the offices of the West Coast of America Telegraph Company at Arica, Pisagua, Iquique, Antofagasta, Caldira, La Serena, Coquimbo, Valparaiso, Santiago, Talcahuano, Concepcion, and Coronel in Chile. O.D. Valparaiso mean time is given as 4h. 46m. 34s. S., L.T.S.
CHINA—	8 5 0 F.	This is used by the telegraph companies (Great Northern and Great Eastern). It is approximately Shanghai time. The foreigners at ports on the coast use their own local mean time. The Chinese at most places use an approximate apparent sun time, obtained from sun-dials. O.D.
Amoy	7 52 16·2 F.	Amoy Custom House mean time. L.T.S.
Chifu	8 5 40 F.	O.D.
Chunking		Local mean time should be 7h. 8m. 8s. F. O.D.
Fuchau	7 57 46·5 F.	Mean time for the meridian of Pagoda anchorage, about 12 miles from Fuchau. O.D.
Hankau	7 37 20 F.	Meridian of Hankau, 114° 20′ 0″ E. O.D.
Hong Kong, Kaulung	7 36 41·7 F.	L.T.S.
Newchwang	8 9 2 F.	This is local mean time of the Chinese town of Zingtzu, known to foreigners as Newchwang. The real Newchwang is 30 miles to the north-east. O.D. The meridian used is that of the Custom House flagstaff, 122° 15′ 30″ E. This has recently been corrected to 122° 14′ 0″ E. A time gun is fired weekly at noon.
Pekin	7 45 54 F.	This is local mean time used by foreigners in Pekin and railways in North China. The telegraphs do not appear to keep a uniform time. It is not Pekin, Tientsin, Shanghai, nor apparent time. O.D.
Shanghai	8 5 43·2 F.	(Zikawei Observatory time). O.D.
	8 5 56·7	is Shanghai mean time. L.T.S.

CHINA (*continued*)—	h. m. s.	
Swatau	7 46 55 F.	Swatau mean time. L.T.S.
Tientsin	7 49 12 F.	Naval school time. The Tientsin Town Hall clock should be 7h. 47m. F. The civil time is determined by the municipal chronometer, from which the community may every Saturday set their watches. This chronometer, however, has sometimes been known to have an error of three minutes. O.D.
COCHIN CHINA—		
Saigon	7 16 56 F.	This refers to the meridian of Saigon. This time is used in Lower Laos, Cambodia, Annam. O.D.
Tongking, Haifong	7 4 39·5 F.	Haifong mean time. L.T.S.
COLOMBIA (Republic of)	4 56 16·4 S.	This is Bogota time, and is used at the principal towns. For certain smaller towns apparent solar time is in use. After December 1, 1898, it is expected that Bogota time will be used throughout the Republic. O.D. A variation of fifteen minutes in the public clocks of Bogota is not rare.
CONGO FREE STATE	1 0 0 F.	Throughout the territory. O.D.
CORSICA—		
Ajaccio	0 25 36 F.	Time in Corsica is measured as that of the meridian 6° 24′ 12″ east of Paris, which corresponds to the Citadel Lighthouse of Ajaccio. O.D.
COSTA RICA	5 36 13·13 S.	This is San José mean time, and is used for all purposes. O.D.
CUBA—		
Havana	5 28 50·45 S.	This refers to the meridian of the observatory. For contributions to the *Bulletin* of international meteorological observations, a difference of 5h. 30m. 0s. S. is used. O.D. 5h. 29m. 23·57s. mean time of the meridian. L.T.S.
CURAÇAO	4 35 46·9 S.	Curaçao mean time. L.T.S.
CYPRUS—		
Nicosia	2 14 0 F.	This is the time adopted at the stations of the Eastern Telegraph Company in Cyprus. O.D.
DENMARK	1 0 0 F.	I.T.B.
ECUADOR—		
Guayaquil	5 24 15 S.	(It may be noticed that this is 0h. 24m. 15s. fast on New York.) This time is used by the Central and South American Telegraph Company stations in Ecuador. O.D.
St. Elena	5 24 3 S.	O.D.

	h.	m.	s.	
EGYPT	2	5	8·9 F.	This is the local mean time of the Abbasizeh observatory. It is used in Cairo, on the Nile, and by railways and telegraphs. O.D. See ALEXANDRIA.
Alexandria	2	4	30·5 F.	A time ball drops to show mean noon at the Great Pyramid. This is the official time for Egypt. O.D.
	1	59	33 F.	The time ball drops a second time for mean noon at Alexandria. O.D.
Port Said	2	9	15 F.	L.T.S.
FALKLAND ISLANDS	3	51	24 S.	O.D.
FIJI—				
Suva	11	55	44 F.	O.D.
FORMOSA	9	0	0 F.	I.T.B.
FRANCE	0	9	21 F.	I.T.B. Paris mean time. The *Standard* of April 7, 1898, says, "Lately the French Chamber of Deputies has passed a law which probably will be approved by the Senate, the text of which is, 'The legal time of France and Algeria is the time which is 9m. 21s. slow on Paris mean time.'" Paris mean time is used by telegraphs and railways, but real railway time is about 5m. slower than this, or 55m. slow on Central European time. Also generally the clocks inside stations are 5m. slow on those outside, these latter showing Paris mean time. Some years ago there was a difference between town time and railway time, but this distinction between a local mean time and Paris mean time is disappearing, and it is only at places without stations that the former is sometimes observed. The times of handing in and receipt of telegrams are usually marked.
GAMBIA—				
Bathurst	1	6	0 S.	Clocks are regulated weekly by the time kept at the telegraph station. O.D.
GERMANY	1	0	0 F.	I.T.B. Used generally.
Potsdam Observatory	0	52	15·4 F.	
Strassburg Observatory	0	31	47 F.	
GIBRALTAR	0	21	23 S.	At 10 a.m. daily a telegraph signal is received from Greenwich. O.D.
GOLD COAST—				
Accra	0	0	46 S.	Used throughout the Gold Coast. This is corrected every day by telegraph from Greenwich, and transmitted to all Government telegraph offices. O.D.

	h. m. s.	
GREAT BRITAIN		Greenwich mean time is the standard time, and is with rare exceptions used for all purposes. Amongst these exceptions we find residents in Canterbury using a time about four minutes fast on Greenwich, and clocks at certain railway stations are sometimes one or two minutes fast. "Apparent Greenwich" and sometimes "local sun" time are used in connection with regulations relating to lamp-lighting. See IRELAND.
GREECE	1 34 53·7 F.	Meridian of Athens. I.T.B.
GUADELOUPE	4 4 0 S.	This approximate local time is regulated by occasional observations. The West Indian and Panama Canal Company use Demerara time, and the Cie Française des Câbles Télégraphiques that of Santiago de Cuba. O.D.
GUATEMALA	6 2 3 S.	Used for all purposes throughout the Republic. O.D.
GUIANA, BRITISH (DEMERARA)— George Town	3 52 39·5 S.	This is post office mean time, and is used throughout the colony.
	3 52 46 S.	is given as the time adopted by the West Indian stations of the West India and Panama Telegraph Company. O.D.
GUIANA, DUTCH— Paramaribo	3 40 35 S.	L.T.S. Paramaribo mean time.
HAWAII	10 30 0 S.	Called standard time. O.D.
HEJAZ	1 55 56 F.	See TURKEY. I.T.B.
HERZEGOVINA	1 0 0 F.	I.T.B.
HONDURAS, BRITISH— Belize	5 52 47 S.	The clock over the Court House, usually regulated by the time kept by ships in the harbour, is the one referred to by the public and public offices. O.D.
HUNGARY	1 0 0 F.	I.T.B.
ICELAND— Reykjavik	1 27 34 S.	O.D.
INDIA		In towns and villages in many parts of India, local and other time is announced by clocks striking, gongs, bells, guns—these signals being given from churches, treasury buildings, forts, telegraph offices, etc. Local time is determined for each place, where there is a Government telegraph office, with reference to its meridian, as so many minutes (the nearest minute to the exact time being taken) in advance of or behind the mean time of the Madras Observatory, which has been adopted as the standard time for the whole of India. This time is telegraphed daily from Madras to every telegraph office. Section XII. of the 'Indian Telegraph Guide,' published in Calcutta, consists of a closely printed table extending over forty-nine pages, showing the difference between Madras time and local mean time for all Government telegraph offices in India.

INDIA (*continued*)—

Madras time is used on through lines of railway, and in recording the time of despatch of foreign telegraphic messages. For all other ordinary public and official transactions, as well as private business, local time is employed. To this, however, there appear to be exceptions, as in Rajputana, Delhi, Umballa, Simla, etc., where Madras time is employed for all purposes. O.D.

The determinations of the difference between Madras time and Greenwich mean time are as follows:—

	h.	m.	s.	s.
Series A.	5	20	59·750	±0·155
„ B.	5	20	59·010	±0·163
„ C.	5	20	59·115	±0·0227
„ D.	5	20	59·233	±0·127
„ E.	5	20	59·421	±0·125

Series C. is the most recently determined, and probably the most accurate. (Meteorological reporter to the Government North-West Provinces and Oudh.)

The Director of the Madras Observatory gives 5h. 20m. 59·4s. F. as the most correct. O.D.

	h. m. s.	
Ajmere—Merwara		Madras time is used, but at the Ajmere Observatory the time used is 22m. later than this. O.D.
Baluchistan—Quetta	5 20 59·4 F.	Madras or railway time. O.D.
Bengal—Calcutta	5 53 20·77 F.	This time is in ordinary use at Bankura, Bhagalpur, Burdwan, Darjiling, Dinajpur, Hooghly, Howrah, Jalpaiguri, Jessore, Khulna, Malda, Midnapore, Murshidabad, Nadiya, Rajshahi, the Twenty-four Parganás. Madras time is used for railways and telegraphs. It is also used by the public at Champaran, Darbhanga, and possibly other places. A local mean time is also in use. O.D.
Bombay, Colaba Observatory	4 51 15·7 F.	L.T.S. This is local mean time used at the observatory.
Central Provinces—Nagpur		Madras civil time. 5h. 20m. 59·4s. F. O.D.
Coorg—Merkasra	5 2 57 F.	O.D.
Hyderabad		Madras or railway time used in Government offices, but local Amraoti time is 10m. S. on this. O.D.
Karachi	4 27 52 F.	L.T.S.
Karikal (French India)	5 21 5·6 F.	Madras time. O.D.
Lucknow		Madras time used by railways, telegraphs, and for public affairs. O.D.

	h. m. s.	
INDIA (*continued*)—		
Madras	5 20 59·4 F.	See INDIA.
Nepal		At Katmandu, the capital, there are neither railways nor telegraphs, and its longitude has not been accurately determined. O.D.
North-West Provinces—		
Allahabad		Madras time used by railways, telegraphs, and for public affairs. O.D.
Oudh		See ALLAHABAD. (Madras time.)
Panjim (Goa)	4 55 28·12 F.	This is official time. The West of India Portuguese railway use Madras time. O.D.
Pondichéry (French India)	5 21 5·6 F.	Madras time. O.D.
Rajputana		Madras time for railways, telegraphs, and public affairs. (Local time is therefore not in use.) O.D.
IRELAND	0 25 22 S.	I.T.B.
ITALY	1 0 0 F.	Since November 1, 1893, the hours are counted consecutively, one to twenty-four, from midnight. O.D.
JAMAICA	5 7 10·41 S.	This time is used throughout the island. O.D.
JAPAN	9 0 0 F.	Since January, 1888, this time has been used for all purposes. It is regulated daily by a time signal sent to all telegraph stations.
JAVA—		
Batavia	7 7 20 F.	For towns in Java and the Dutch East Indies, local mean time is used. For the railways, Batavia time is kept for West Java, Samarang time for Mid-Java, and Surabaya time for East Java. O.D.
Tanjong Priok	7 7 32·6 F.	L.T.S. Tanjong Priok mean time.
Surabaya	7 30 57·4 F.	L.T.S. Surabaya mean time.
KOREA	9 0 0 F.	I.T.B. O.D.
LAGOS	0 13 43 F.	A time signal is obtained daily by telegraph. The time shown by the station clock is 0h. 14m. 0s. F. O.D.
LEEWARD ISLANDS—		
Antigua	4 20 0 S.	The time used is that shown by the cathedral clock in the city of St. John, which is regulated by a daily telegraph signal from British Guiana, which is said to be 0h. 14m. 49s. fast on Antigua. O.D. See GUIANA, BRITISH.
MADAGASCAR—		
Antananarivo	3 10 7 F.	The meridian is that of the Observatory, 15° 11′ 30″ E. of Paris.
Tamatave	3 17 41 F.	O.D.
MALTA	1 0 0 F.	or Central European mean time since November 1, 1894. O.D.
MARTINIQUE	4 4 44 S.	Meridian of the St. Pierre lighthouse. O.D.

	h. m. s.	
MAURITIUS—		
Port Louis	3 50 12·6 F.	Meridian of the Royal Alfred Observatory. O.D.
		The railways keep a time 5m. behind that shown by the cathedral clock in Mexico, and this is telegraphed every morning to the stations on the line.
MEXICO—		
Mexico	6 36 31·56 S.	Longitude of the Central Meteorological Observatory at Mexico, and is the time kept on Mexican railways. O.D.
Mexico	6 35 0 S.	Statement by the Mexican Telegraph Company.
Tampico	6 15 0 S.	Ditto ditto.
Vera Cruz	6 24 0 S.	Ditto ditto.
MIQUELON	3 44 44 S.	O.D.
NATAL	2 0 0 F.	Throughout the colony, regulated by a signal from Durban. O.D.
NETHERLANDS (HOLLAND)		Greenwich mean time for railways, telegraphs, and post. Many places use Amsterdam mean time, which is approximately 20m. fast on Greenwich. Some places use Greenwich mean time or their own local time. O.D.
Amsterdam	0 19 39 F.	Amsterdam mean time. L.T.S.
Flushing	0 14 23·2 F.	Flushing mean time. L.T.S.
Hellevoetsluis	0 16 30·7 F.	Hellevoetsluis mean time. L.T.S.
Nieuwe Diep (Willemsoord)	0 19 6·4 F.	Nieuwe Diep mean time. L.T.S.
Rotterdam	0 17 59·1 F.	Rotterdam mean time. L.T.S.
NEW CALEDONIA	11 5 48 F.	O.D. This is stated as being 1h. 12m. 0s. F. on Queensland. See AUSTRALIA.
NEWFOUNDLAND—		
St. John's	3 30 49·5 S.	This is used for all purposes throughout the island, including telegraph offices, excepting that of Heart's Content, which uses its local time of 3h. 33m. 33s. S. on Greenwich mean time, and is obtained by signal from London. All foreign cable business is transmitted from Heart's Content with Greenwich time. O.D.
	3 30 43·1 S.	St. John's mean time. L.T.S.
NEW GUINEA, BRITISH		
Daru	9 32 52 F.	
Mouth of Mambari river	9 52 8 F.	
Port Moresby	9 48 36 F.	
Samarai	10 2 39 F.	
NEW GUINEA, DUTCH		Local mean time. See JAVA.
NEW ZEALAND	11 30 0 F.	This has been in use since 1868. O.D.
NICARAGUA	5 45 10 S.	This is based on the longitude of Managua. It is used between 11° 15′ 44″ N. lat. to 12° 46′ 0″ N. lat., and 84° 22′ 37″ W. long.

	h.	m.	s.	
				to 87° 12′ 31″ W. long. In this area we find the principal telegraph offices—Managua, Granada, San Juan del Sur, Leon, Chinandega, Corinto, Metagalpa, El Orotal, San Carlos, El Castillo. On the Atlantic coast (Greytown, Bluefield, Cape Gracias di Dios) the local time depending on longitude is used. An official time is not strictly observed. O.D.
NORWAY	1	0	0 F.	Since June 29, 1894. O.D.
ORANGE FREE STATE	1	30	0 F.	Regulated by the Cape Town signal.
PERSIA—				
Teheran	3	26	0 F.	This local mean time for Teheran is kept on the Indo-European telegraph system, and is practically the same for all stations on the north-south line to Bushir. It is regulated by a time signal received daily from Greenwich. Local mean time is also kept for Meshed and Ispahan. The Persians keep sun time, watches being set at sunset. In Teheran there is a mid-day gun fired by the time shown on a sun-dial. The tramway company keep gun-time. The railway trains start when full or when required. Persian telegraphists do not give time of issue or receipt of telegrams. O.D.
PERU—				
Arequipa	4	46	12 S.	As this is determined by primitive methods it may occasionally be in error one or two minutes.
Cable companies	4	46	30 S.	This is the time kept in the offices of the West Coast of America Telegraph Company at Callao, Lima, and Mollendo. See CHILE.
Central Railway				Mean Lima time. O.D.
Lima	5	8	9 S.	The meridian is that of the cathedral tower in Lima. O.D.
Pacasmayo				Time taken from steamers and by telegraph. O.D.
Paita Railway	5	28	0 S.	Time comes by cable from New York, and is then corrected. O.D.
Southern Railway				Arequipa time is used on the southern railways which extend from Mollendo to Puno on Lake Titicaca to Sicuani. This time is used in Mollendo, and probably at other places on the line. O.D.
Trujillo.				Time taken from steamers and by telegraph. O.D.
PESCADORES	9	0	0 F.	I.T.B.
PHILIPPINE ISLANDS —				
Manila	8	3	52 F.	Manila mean time. L.T.S.

	h. m. s.	
PORTUGAL—		
Lisbon	0 36 44·68 S.	This is the time at the Tapada Roya Observatory. It is also telegraph time. Railway clocks show a time five minutes slow on this. In the country towns a rough local time is kept.
RÉUNION	3 43 20 F.	The railway keeps a time 10m. slow on this.
RHODESIA	1 30 0 F.	Regulated by the Cape Town signal.
RUMANIA	2 0 0 F.	O.D. For telegraph purposes the meridian of Bucharest is employed. I.T.B.
RUSSIAN EMPIRE (Russia, Finland, Caucasus, Siberia, Turkestan)		
		Throughout the Russian Empire local mean times are used at observatories, for a complete list of which see 'Resumés Mensuels et Annuels des Observations Météorologiques,' anné 1895. For telegraphic purposes in Russia, St. Petersburg mean time is used. O.D. The following are examples of local mean time employed in the Russian Empire:—
Åbo	1 29 9 F.	L.T.S.
Char Kow	2 24 58·8 F.	
Ekaterinburg	4 2 32·9	O.D.
Helsingfors	1 39 48·5 F.	Helsingfors mean time. L.T.S.
	1 39 49·2 F.	O.D.
Irkutsk	6 57 15	O.D.
Kronstadt	1 59 3·6	L.T.S.
Nicolaeff (Black sea)	2 7 53·9 F.	L.T.S.
Pavlosk	2 1 54·7 F.	O.D.
Riga	1 36 22 F.	Riga (Sailors' Home mean time).
	1 36 28 F.	Polytechnique House time. L.T.S.
St. Petersburg	2 1 18·7 F.	Pulkova Observatory mean time. From the longitude of St. Petersburg, 30° 18′ 22″ E., it becomes 2h. 1m. 13·4s. F. L.T.S.
	2 1 4·7 F.	O.D.
Tashkent	4 37 10·8 F.	O.D.
Tiflis	2 59 5·7 F.	O.D.
Uleåborg	1 42 2 F.	L.T.S.
Vladivostok	8 47 33·5 F.	L.T.S.
ST. CROIX	4 19 43 S.	Meridian of St. Thomas. O.D.
ST. HELENA	0 22 50 S.	This is local time, but the ball at the time office drops at 1h. 0m. 0s. P.M. Greenwich mean time. Long. 5° 42′ 25″ W. approx. L.T.S. „ 5° 42′ 42″ W. „ 5° 42′ 30″ W. This is the longitude of Ladder Hill Observatory, and is used for local time. Long. 5° 40′ 28″ W. In some Admiralty charts. Long. 5° 43′ 55″ W. Admiralty chart, 1898. The difference between the two latter in time is 13·8s. O.D.

	h. m. s.	
St. John (West Indies)	4 19 43 S.	Meridian of St. Thomas. O.D.
St. Lucia—		
Castries	4 4 0 S.	L.T.S.
	4 4 1 S.	O.D.
St. Paul de Loanda	0 52 53·7 F.	St. Paul de Loanda mean time. L.T.S.
St. Pierre	3 44 44 S.	O.D.
St. Thomas	4 19 43 S.	Meridian of St. Thomas. O.D.
Samoa	11 26 59·7 S.	This is local mean time determined by observation at Ruge's Wharf, Apia harbour. O.D.
Senegal, French—		
Dakar, West Africa	1 9 42 S.	This return was furnished by Captain S. Harvard, of the French ship *Héroine*, who also gave the longitude of Dakar as 19° 45′ 35″ west of Paris. It is only used in the colony of Senegal proper. O.D. The telegraphs employ the mean time of the meridian of the roadstead of Dakar. I.T.B.
Servia	Meridian of Belgrade. I.T.B.	
Seychelles—		
Port Victoria	3 41 49·44 F.	O.D.
Siam—		
Bangkok	6 41 58·4 F.	This refers to the meridian of the old flagstaff at the palace, Bangkok. Time is wired daily to telegraph stations. The railway uses this time, but regulates its clocks five minutes *behind* it. O.D.
Sierra Leone—		
Freetown	0 52 58·3 S.	O.D.
Spain	Official time is determined by the meridian of each locality. Railway time is that of Madrid, and therefore an exception to the general rule. O.D. The telegraphs also use Madrid time.	
Algeciras	0 21 43	O.D.
Barcelona	0 8 38 F.	O.D.
Bilbao	0 11 42 S.	
Cadiz	0 25 10 S.	O.D.
	0 24 49·6 S.	For San Fernando. L.T.S.
Cartagena	0 3 59 S.	O.D.
Ferrol	0 32 51 S.	O.D.
Madrid and the railways	0 14 45 S.	O.D.
Malaga	0 17 44 S.	O.D.
Seville	0 23 58 S.	O.D.
Toledo	0 16 8 S.	O.D.
Valencia	0 1 29 S.	O.D.
Valladolid	0 18 52 S.	O.D.
Straits Settlements—		
Penang	6 41 22 F.	O.D.
Singapore	6 55 25·05 F.	O.D.

	h. m. s.	
SUMATRA		Local mean time. See JAVA.
SUNDA ISLANDS		Local mean time. See JAVA.
SWEDEN	1 0 14 F.	O.D.
SWITZERLAND	1 0 0 F.	I.T.B.
SYRIA—		
Beirut		The ordinary reckoning used in Mohammedan countries. Twelve o'clock is at sunset, which is the beginning of the day, and two periods of twelve hours pass till next sunset, when the watch is set backwards or forwards according to the season. The observatory at Beirut uses its mean time, 2h. 21m. 53s. ± 2s. F. O.D. Telegraphs and the Beirut-Damascus Railway do not keep accurate time.
TASMANIA—		
Hobart	10 0 0 F.	Since August 23, 1895. O.D.
TONGA—		
Nukualofa	11 40 48·12 F.	This is a local mean time kept throughout the kingdom. This time is verified by the chronometers of men-of-war, mail steamers, and by meridian altitudes. O.D. The longitude of Nukualofa town flagstaff is 175° 12′ 3″ W., but because all business relations, with the exception of Samoa, are in east longitude, east longitude time for the day of the week and month are kept.
TRANSVAAL	1 30 0 F.	O.D.
TRINIDAD	4 6 2·5 S.	This is local mean time for the meridian of Port of Spain. The accuracy with which it is kept depends upon comparisons with a regulator and a ship's chronometer, and it is not great. O.D.
TRIPOLI	1 55 56 F.	Like Turkey. I.T.B.
TUNIS	0 9 21 F.	I.T.B. This is Paris time. O.D.
TURKEY	1 55 56 F.	I.T.B.
	2 0 0	O.D.
UNITED STATES—		
East coast to 82½°	5 0 0 S.	Eastern time. Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Rhode Island, New Jersey, Pennsylvania, Maryland, Virginia, N. Carolina, S. Carolina, Georgia, Florida.
82½° to 97½°	6 0 0 S.	Central time. Minnesota, Wisconsin, Michigan, Iowa, Illinois, Indiana, Ohio, Missouri, Kentucky, Tennessee, Arkansas, Mississippi, Alabama, Louisiana.
97½° to 112½°	7 0 0 S.	Mountain time. Montana, Dakota, Wyoming, Nebraska, Utah, Colorado, Kansas, Arizona, New Mexico, Texas.
112½° to west coast	8 0 0 S.	Pacific time. Washington, Oregon, Idaho, Nevada, California. L.T.S. The time of "handing in" is not stated on telegrams. I.T.B.

Dividing Points.

On the time used for city or local purposes at Dividing Points between the standard time sections in the United States and Canada. C.T. = Central Time; M.T. = Mountain Time; P.T. = Pacific Time; E.T. = Eastern Time. The names of states, etc., are abbreviated in the usual manner.

Between Central and Mountain Sections.

Alliance, Neb.	M.T. locally.	Mandan, N. Dak.	M.T. locally.
Brandon, Man.	C.T. „	McCook, Neb.	M.T. „
Dodge City, Kan.	C.T. for city.	Minot, N. Dak.	C.T. „
Ellis, Kan.	C.T. locally.	North Platte, Neb.	C.T. „
El Paso, Tex.	M.T. „	Oakley, Kan.	M.T. „
Holyoke, Colo.	C.T. „	Portal, N. Dak.	C.T. „
Hoisington, Kan.	C.T. „	Phillipsburg, Kan.	C.T. „
Long Pine, Neb.	C.T. „	Texline, Tex.	M.T. „

Between Mountain and Pacific Sections.

Barstow, Cal.	M.T. locally.	Hope, Idaho	P.T. locally.
Deming, N.M.	M.T. „	Huntington, Oregon	P.T. „
Donald, B.C.	P.T. „	Mojave, Cal.	P.T. „
E. Spokane, Wash.	M.T. „	Ogden, Utah	M.T. „

Between Eastern and Central Sections.

Asheville, N.C.	E.T. locally.	Jamestown, N.Y.	E.T. locally.
Ashley Junction, S.C.	E.T. „	Kane, Pa.	E.T. „
Athens, Ga.	C.T. for city.	Kenova, W. Va.	C.T. „
Atlanta, Ga.	C.T. „	Mount Jewett, Pa.	E.T. „
Augusta, Ga.	E.T. „	Oil City, Pa.	E.T. „
Benwood, W. Va.	E.T. locally.	Parkersburg, W. Va.	E.T. for city.
Bristol, Tenn.	E.T. „	Pittsburg, Pa.	E.T. „
Buffalo, N.Y.	E.T. for city.	Port Huron, Mich.	E.T. „
Butler, Pa.	E.T. locally.	St. Thomas, Ont.	E.T. „
Columbia, S.C.	E.T. „	Salamanca, N.Y.	E.T. locally.
Corry, Pa.	E.T. „	Salisbury, N.C.	E.T. „
Detroit, Mich.	C.T. legal time	Sarnia, Ont.	E.T. city.
		Sault Ste. Marie, Mich.	C.T. locally.
Local time is 28m. fast on C.T.		Sault Ste. Marie, Ont.	E.T. „
Dunkirk, N.Y.	E.T. for city.	Sheffield Junction, Pa.	E.T. „
Erie, Pa.	E.T. „	Union City, Pa.	E.T „
Fort William, Ont.	C.T. „	Washington, Pa.	E.T. for city.
Foxburg, Pa.	E.T. „	West Clifton Forge, Va.	E.T. locally.
Franklin, Pa.	E.T. „	Wheeling, W. Va.	E.T. for city.
Gainesville, Ga., city uses mean local time.		Windsor, Ont. (see Detroit).	
		Clifton Forge, Va.	E.T. locally.

The railroads meeting or passing through the above places use at least two times differing by an hour, one for the westward-bound trains, and the other for those bound eastwards. At El Paso, Tex., where lines converge from various directions, there are four kinds of railway time: C.T. for the Southern Pacific-Atlantic System, Texas and Pacific; M.T. for the Atchison, Topeka, and Santa Fe; P.T. for the Southern Pacific-Pacific System; City of Mexico time for the Mexican Central.

There are but few points of importance where mean solar time is used in the United States. It is used at Detroit, Michigan (population 200,000), and Savannah, Ga. (population 44,000). There are also a few points mostly in Ohio, Indiana, and Michigan. For further information, see 'Travellers' Official Guide of the Railways and Steam Navigation Lines in the United States, Canada, and Mexico,' from which the above tables were taken, 24, Park Place, New York.

	h. m. s.	
URUGUAY—		
Monte Video	3 44 49·56 S.	This is local mean time, and is supposed to be used throughout the country. Railway time is about 5m. slower than this. O.D.
WINDWARD ISLANDS—		
Grenada	4 6 59·40 S.	
St. Vincent	4 5 0 S.	This is about the time. It depends on a periodical telegram from Demerara, and on the time from ships of war when the clocks are set. O.D.
ZULULAND	2 0 0 F.	Every day, excepting Sundays, a telegraphic time signal is received from Durban. O.D.

TABLES ISSUED BY TELEGRAPH COMPANIES.

They may now be different. See Preface.

December 1, 1898.

Place.	Eastern Telegraph Company, Ltd., July 1, 1897.	Indo-European Telegraph Company, Ltd., Oct. 1897.	Western Union Telegraph Company.
	h. m.	h. m.	h. m.
Acapulco	6 39 S.	—	—
Accra	—	—	—
Adelaide	9 0 F.	9 14 F.	9 14 F.
Aden	3 0 F.	—	3 0 F.
Agra	—	5 11 F.	—
Akyab	6 11 F.	6 11 F.	—
Alexandria	2 5 F.	—	1 59 F.
Algiers	0 10 F.	—	0 11 F.
Amoy	8 5 F.	7 52 F.	7 52 F.
Amsterdam	—	—	0 19 F.
Assuncion	3 50 S.	—	—
Athens	1 35 F.	—	1 34 F.
Auckland	11 23 F.	11 32 F.	—
Augusta, Ga.	—	—	6 0 S.
Bahia	2 52 S.	—	2 33 S.
Baltimore	—	—	5 0 S.
Bangkok	6 41 F.	6 41 F.	—
Banjoewangie	7 7 F.	7 37 F.	—
Barbados	3 58 S.	—	3 58 S.
Batavia	7 7 F.	7 7 F.	—
Bathurst (Africa)	1 6 S.	—	—
Bathurst (New South Wales)	—	9 16 F.	—
Belize	5 53 S.	—	5 53 S.
Bencoelen	—	6 49 F.	—
Benguella	0 53 F.	—	—
Berlin	1 0 F.	0 53 F.	0 53 F.

Place.	Eastern Telegraph Company, Ltd., July 1, 1897.	Indo-European Telegraph Company, Ltd., Oct. 1897.	Western Union Telegraph Company.
	h. m.	h. m.	h. m.
Bermuda	4 19 S.	—	4 19 S.
Berne	1 0 F.	—	0 29 F.
Bogota	4 57 S.	—	4 57 S.
Bombay	5 21 F.	4 51 F.	4 51 F.
Bona	0 10 F.	—	—
Bonny	0 28 F.	—	—
Borneo	7 39 F.	—	—
Boston	—	—	5 0 S.
Bremen	—	—	0 35 F.
Brest	0 18 S.	—	0 18 S.
Brisbane	10 0 F.	10 12 F.	—
Brussels	—	—	0 17 F.
Buenos Ayres	4 16 S.	—	3 53 S.
Bushir	3 23 F.	3 23 F.	—
Bussora	—	3 11 F.	—
Cadiz	0 15 S.	—	0 25 S.
Cairo	2 5 F.	—	2 5 F.
Calcutta	5 21 F.	5 53 F.	5 53 F.
Callao	5 8 S.	—	5 8 S.
Canton	7 33 F.	7 33 F.	—
Cape de Verd islands	1 40 S.	—	1 40 S.
Cape Town	1 30 F.	—	1 13 F.
Cayenne	3 29 S.	—	8 29 S.
Ceara	2 34 S.	—	2 34 S.
Charlestown	5 20 S.	—	5 0 S.
Chicago	5 50 S.	—	6 0 S.
Christchurch, New Zealand	11 32 F.	11 32 F.	11 82 F.
Christiania	1 0 F.	—	0 43 F.
Colombo	5 19 F.	5 19 F.	—
Conception	4 52 S.	—	4 52 S.
Constantinople	2 0 F.	1 56 F.	1 56 F.
Copenhagen	1 0 F.	—	0 50 F.
Copiapo	4 42 S.	—	—
Coquimbo	4 45 S.	—	4 45 S.
Dallas, Texas	—	—	6 0 S.
Delagoa bay	2 12 F.	—	—
Denver	—	—	7 0 S.
Detroit	—	—	6 0 S.
Dunedin	11 22 F.	11 22 F.	—
Durban	1 58 F.	—	2 2 F.
Duxbury	4 44 S.	—	—
Fernando Po	0 36 F.	—	—
Florence	—	—	0 45 F.
Fuchau	8 5 F.	—	—
Funchal	1 8 S.	—	1 8 S.
Gainsvile	—	—	6 0 S.
Galle	5 20 F.	5 20 F.	—
Galveston	—	—	6 0 S.
Genoa	—	—	0 36 F.
George Town (Demerara)	3 53 S.	—	3 53 S.
Gibraltar	0 21 S.	—	0 21 S.
Graham's Town	1 46 S.	—	—
Great Salt Lake City (Utah)	7 28 S.	—	—
Guatemala	6 2 S.	—	6 2 S.
Guayaquil	5 19 S.	—	5 19 S.
Halifax	4 15 S.	—	5 0 S.
Hamburg	—	—	0 39 F.
Havana	5 29 S.	—	5 29 S.
Heart's Content	3 34 S.	—	—
Hobart Town	8 5 F.	9 50 F.	—

Place.	Eastern Telegraph Company, Ltd., July 1, 1897.	Indo-European Telegraph Company, Ltd., Oct. 1897.	Western Union Telegraph Company.
	h. m.	h. m.	h. m.
Hokitika	11 24 F.	11 24 F.	—
Hong Kong	8 5 F.	7 36 F.	7 36 F.
Honolulu	10 31 S.	—	10 31 S.
Houston, Texas	—	—	6 0 S.
Ispahan	—	3 27 F.	—
Ivercargill	—	11 12 F.	—
Jamaica	5 6 S.	—	5 6 S.
Jerusalem	2 21 F.	2 21 F.	—
Jitomir	—	1 55 F.	—
Juan Fernandez	5 16 S.	—	—
Kabul	4 57 F.	—	—
Kansas city	—	—	6 0 S.
Kertch	—	2 26 F.	—
Key West, Flo.	5 26 S.	—	5 26 S.
Kingston (Jamaica)	5 7 S.	—	5 7 S.
Kioto	9 0 F.	—	—
Kurrachi	5 21 F.	4 27 F.	—
Lahore	—	4 57 F.	—
Larnaca	2 14 F.	—	—
Lima	5 8 S.	—	5 8 S.
Lisbon	0 36 S.	—	0 36 S.
Loanda	0 53 F.	—	—
Madeira	1 7 S.	—	1 7 S.
Madras	5 21 F.	5 21 F.	5 21 F.
Madrid	0 15 S.	—	0 15 S.
Malacca	6 49 F.	6 49 F.	—
Malta	0 58 F.	—	0 58 F.
Manila	8 3 F.	8 3 F.	8 3 F.
Marseilles	0 10 F.	—	0 21 F.
Mauritius	3 50 F.	3 50 F.	3 50 F.
Mecca	2 0 F.	2 40 F.	—
Melbourne	10 0 F.	9 40 F.	9 40 F.
Memphis	—	—	6 0 S.
Mendoza	4 35 S.	—	—
Mexico	6 36 S.	—	6 36 S.
Milan	—	—	0 37 F.
Milwaukee	—	—	6 0 S.
Minneapolis	—	—	6 0 S.
Mobile, Ala.	—	—	6 0 S.
Montevideo	3 45 S.	—	3 45 S.
Montreal	4 54 S.	—	5 0 S.
Moscow	—	—	2 30 F.
Mossamedes	0 49 F.	—	—
Moulmein	6 30 F.	6 30 F.	—
Mozambique	2 43 F.	—	2 43 F.
Munich	—	—	0 46 F.
Nagasaki	9 0 F.	8 40 F.	8 40 F.
Nanking	—	7 55 F.	—
New Orleans	6 0 S.	—	6 0 S.
Newport	6 4 S.	—	5 0 S.
New York	4 56 S.	—	5 0 S.
Nice	—	—	0 22 F.
Norfolk, Va.	—	—	5 0 S.
Odessa	2 2 F.	2 2 F.	2 2 F.
Otago	11 23 F.	—	—
Panama	5 18 S.	—	5 18 S.
Para	2 52 S.	—	3 14 S.
Paranabyba	2 47 S.	—	—
Paris	0 10 F.	—	0 9 F.
Pekin	7 46 F.	7 46 F.	7 46 F.

Place.	Eastern Telegraph Company, Ltd., July 1, 1897.	Indo-European Telegraph Company, Ltd., Oct. 1897.	Western Union Telegraph Company.
	h. m.	h. m.	h. m.
Penang	6 42 F.	6 42 F.	—
Pensacola, Flo.	—	—	6 0 S.
Perim	3 0 F.	—	—
Pernambuco	2 20 S.	—	2 20 S.
Perth, West Australia	—	7 43 F.	—
Philadelphia	5 1 S.	—	5 0 S.
Pondicherry	—	5 19 F.	—
Port Darwin	9 0 F.	8 44 F.	—
Portland	—	—	8 0 S.
Port Nolloth	1 8 F.	—	—
Porto Rico	4 26 S.	—	4 26 S.
Pouna	—	4 55 F.	—
Pretoria	1 54 F.	—	1 54 F.
Principe	0 40 F.	—	—
Providence, R.I.	—	—	5 0 S.
Quebec	4 45 S.	—	5 0 S.
Quito	5 13 S.	—	5 13 S.
Rangoon	6 20 F.	6 20 F.	—
Rio Grande do Sul	2 52 S.	—	3 29 S.
Rio de Janeiro	2 52 S.	—	2 52 S.
Rome	1 0 F.	—	0 49 F.
Saigon	7 6 F.	7 6 F.	—
St. Louis	6 0 S.	—	6 0 S.
St. Paul	—	—	6 0 S.
St. Petersburg	2 1 F.	—	2 1 F.
St. Thomas	4 19 S.	—	4 19 S.
St. Thomé	0 26 S.	—	—
St. Vincent (Cape de Verd)	1 40 S.	—	1 40 S.
Salonica	1 0 F.	—	1 32 F.
Samarang	7 7 F.	7 21 F.	—
Sandwich islands	10 31 S.	—	10 31 S.
San Francisco	8 8 S.	—	8 0 S.
San José	5 35 S.	—	5 35 S.
Santa Catharina	3 13 S.	—	3 13 S.
Santiago de Chili	4 43 S.	—	4 43 S.
Santos	3 6 S.	—	3 6 S.
Savannah	—	—	6 0 S.
Scio	2 0 F.	—	1 44 F.
Shanghai	8 5 F.	8 5 F.	8 5 F.
Sierra Leone	0 53 S.	—	—
Simla	—	5 1 F.	—
Singapore	6 55 F.	6 55 F.	6 55 F.
Smyrna	2 0 F.	1 49 F.	1 49 F.
Sourabaya	7 7 F.	7 30 F.	—
Stockholm	—	—	1 12 F.
Suakin	2 29 F.	—	2 29 F.
Suez	2 5 F.	—	2 10 F.
Sukum Kaleh	—	2 44 F.	—
Sydney	10 0 F.	10 5 F.	—
Tabriz	—	3 5 F.	—
Tamatave	3 17 F.	—	—
Tangier	0 23 S.	—	—
Teheran	3 25 F.	3 25 F.	—
Tiflis	—	2 59 F.	—
Tokio	9 0 F.	—	9 18 F.
Toronto	5 18 S.	—	5 0 S.
Trieste	1 0 F.	—	0 55 F.
Trinidad	4 6 S.	—	4 6 S.
Tripoli	2 0 F.	—	0 52 F.
Truxillo	5 16 S.	—	5 16 S.

Place.	Eastern Telegraph Company, Ltd., July 1, 1897.	Indo-European Telegraph Company, Ltd., Oct. 1897.	Western Union Telegraph Company.
	h. m.	h. m.	h. m.
Tunis	0 40 F.	—	0 40 F.
Valdivia	4 53 S.	—	4 53 S.
Valentia (Ireland)	0 41 S.	—	—
Valparaiso	4 46 S.	—	4 46 S.
Vancouver island	8 14 S.	—	8 0 S.
Venice	—	—	0 49 F.
Vera Cruz	6 25 S.	—	6 25 S.
Vienna	1 0 F.	—	1 5 F.
Vigo	0 15 S.	—	0 35 S.
Villa Real	0 36 S.	—	0 29 S.
Warsaw	—	1 24 F.	—
Washington	5 8 S.	—	5 0 S.
Wellington	11 38 F.	11 38 F.	11 38 F.
Yeddo	—	9 18 F.	—
Yokohama	—	—	9 19 F.
Zanzibar	2 37 F.	—	2 37 F.
Zürich	—	—	0 34 F.

Original Time.

The following table gives the particulars of the time recognized by the forwarding country (see footnote):—

Austria.	Mid-Europe.
Bavaria.	Mid-Europe.
Belgium.	West Europe.
Bosnia-Herzegovina.	Mid-Europe.
Bulgaria.	East Europe.
Cape Colony and Orange Free State.	One and a half hour in advance of Greenwich.
Cochin China and Cambodia.	Saigon.
Denmark.	Mid-Europe.
Egypt.	Cairo.
France and Algeria.	Paris.
Germany.	Mid-Europe.
Great Britain and Ireland.	Greenwich.
Greece.	Athens.
Holland.	West Europe.
Hungary.	Mid-Europe.
India.	Madras.
Italy.	Mid-Europe.
Japan.	Kioto.
Java and Sumatra.	Batavia.
Luxemburg.	West Europe.
New South Wales.	Ten hours in advance of Greenwich.
Norway.	Mid-Europe.
Portugal.	Lisbon.
Queensland.	Ten hours in advance of Greenwich.
Roumania.	East Europe.
Russia.	St. Petersburg.
Senegal.	St. Louis.

Servia.	Mid-Europe.
Siam.	Bangkok.
South Australia.	Nine hours in advance of Greenwich.
Spain.	Madrid.
Sweden.	Mid-Europe.
Switzerland.	Mid-Europe.
Tasmania.	Ten hours in advance of Greenwich.
Tunis.	Tunis.
West Turkey.	Mid-Europe.
East Turkey, including Hedjaz, Yemen, and Tripoli.	East Europe.
Victoria.	Ten hours in advance of Greenwich.
Würtemberg.	Mid-Europe.

Local time is used at the companies' stations, except at places where telegraphs are under Government control.

On telegrams from North America London time is signalled (*pro ex.*, see Newfoundland).

[Extracted from the Rules and Regulations of the Eastern Telegraph Company, the Eastern Extension, Australasia and China Telegraph Company, West African Telegraph Company, the Europe and Azores Telegraph Company, and the Eastern and South African Telegraph Company.]

THE MONTHLY RECORD.

EUROPE.

Landslip at Airolo.—On December 27, a serious landslip occurred from the Sasso Rosso, above Airolo, on the St. Gothard railway, resulting in the loss of three lives and the destruction of the Hotel Airolo and several adjacent houses. The volume of the material which fell is calculated at 400,000 cubic metres (14,000,000 cubic feet). In the opinion of Swiss geologists the danger is not yet over, as a mass of rocks equal to that which has already fallen remains suspended on the flank of the mountain, and, apparently, has yet to come away.* It is hoped, however, that it may be detached in smaller masses than was the case in the first slip. The summit of the Sasso Rosso is nearly 4000 feet above Airolo. The recent slip was but small compared with some of the historic catastrophes of similar nature, the material which fell at Brienz in 1749 having been calculated at over one hundred times the volume given above.

AFRICA.

The Geology of Southern Morocco and the Atlas Mountains.—At the meeting of the Geological Society on January 18, a paper on this subject, by the late Mr. Joseph Thomson, was read. The paper gives the results of observations made under considerable difficulties during a journey in Morocco in 1888. The tract traversed is roughly triangular, the base being the Atlantic ocean between Saffi and Agadir, and the apex the district of Dunnat, on the northern slopes of the Atlas, some 60 miles east of the city of Morocco. This district consists of three main sections:—(1) The Coast Lowlands; (2) The Plateau in two chief steps, the northern rising to 2000 and the southern to 5000 feet; (3) The Atlas itself, which only begins to be a mountain chain about 30 miles from the coast, and which ranges first east-by-north and then north-east in its central and loftiest part. (1) The Lowlands are practically coterminous with the Tertiary deposits, amongst which apparently Eocene, Miocene, and Pliocene rocks are represented. The latter consist of shelly sands 200 to 300 feet thick, gradually rising to a height of 700 feet to the south and east of Saffi. Its surface is often covered with the slaggy tufaceous crust described by Maw. The local presence of this crust and the porous character of the deposit elsewhere has preserved it from denudation, so that, in the opinion of the author, its surface still presents the appearance of the Tertiary sea-bed on which it was formed. Certain quarry-like pits, one of which contains a pillar of white crystalline carbonate of lime, are supposed to be due to the explosion of steam connected with the existence of hot springs. (2) The Plateau is underlain by three rock-formations: (*a*) Metamorphic rocks, including clay-slates, which probably underlie the whole plain of Morocco and rise into a group of rugged hills called the "Jebelet," in contradistinction to the "Jebel," the Atlas proper. (*b*) The Lower Cretaceous rocks, consisting of red shales and sandstones, the former frequently giving rise to salt springs, and containing salt-deposits at Demnat, in the Atlas. (*c*) The Upper Cretaceous rocks, chiefly white and cream-coloured limestones, which attain their greatest development on the plateau. (3) The Atlas itself is made up for the most part of the same rocks. There is a core of Metamorphic rocks, which is better developed and wider at the western end of the range, and narrower towards the east. Next comes the great development of the Lower Cretaceous strata, followed by a diminutive representative of the Upper Cretaceous rocks. These rocks are much broken by folding and faulting, and their structure is displayed in several sections taken across the range from Demnat westward. The first signs of glacial action were met with at Titula, consisting of moraine-like heaps of *débris;* elsewhere, scratched stones were found. The boulder deposits described by Maw were not seen either to east or west of the place described by that author; but Maw's original section was not traversed, and the present author does not offer any opinion on the origin of the beds. Intrusive basalts penetrate the Cretaceous rocks and porphyrites, diorites, and other igneous rocks, the Metamorphic rocks of the central core.

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* Further slips, on a minor scale, have since been reported.

New Ascent of Kilimanjaro.—The second number of the new volume of *Globus* records the ascent by Captain Johannes, commandant of the German station at Moshi, of the Kibo crater of Mount Kilimanjaro, it being the first occasion on which the crater was reached by a European since Dr. Mayer's ascent. Five days were occupied in the task, a succession of bivouacs being made on the mountain, for which the sleeping-bags left behind by Dr. Mayer proved of much service. The last bivouac was made on October 7, at a height of 15,400 feet, from which point the remaining distance was accomplished on the following day, the party starting at 4.15 a.m., and reaching the summit known as the "pulpit" soon after midday, quite exhausted. The Hans Mayer gap was quite free from snow and ice. The highest summit was not ascended, but, photographs and temperature observations having been taken, the descent to Moshi was made in two days. In the gap of the crater-wall, at a height of 19,000 feet, the dry-bulb thermometer registered 40° Fahr., the wet-bulb 28·4°, at 1 p.m.

Journey across the Equatorial Forest.—Mr. Albert B. Lloyd, lay missionary in Uganda, has lately returned to England after a rapid and successful journey to the West Coast by way of the great equatorial forest and the Congo. His route through the forest lay, in its first portion, somewhat to the south of Stanley's, but seems to have coincided roughly with that of M. Versepuy and Baron de Romans in 1896. Mr. Lloyd has communicated to the press some interesting details respecting the journey. Starting from Toru, east of Mount Ruwenzori, on September 19 last, with two native servants and a few porters, he struck south for Fort Katwe, and followed the Semliki down to Mbeni, the extreme outpost of the Congo State. Regarding the situation in Toru, he reports marvellous progress under the administration of Captain Sitwell, the country having remained quiet during all the disturbances in Uganda. Leaving Mbeni on October 1, Mr. Lloyd at once entered the forest, in the gloomy shades of which he remained for twenty days. He was fortunate in entering into friendly relations with the pygmies, some of whom he was able to photograph. None of those which he measured reached a height of 4 feet. He was struck by the beards of the men, reaching halfway down their chests, which gave them a singular appearance. Although this feature was not observed by Stanley or Stuhlmann, bearded individuals were seen by Emin in the Monbuttu country, and the dwarfs have obtained from the Arabs the nickname "Fathers of the span-long beard." Mr. Lloyd passed only a few small villages, occupied by so-called Arabs, which serve as auxiliary Belgian stations. At times he came upon fairly good tracks, but at others it was necessary to cut a way through the undergrowth. Perpetual twilight reigned, and a death-like stillness, broken only by the crash of fallen trees, which sometimes put the travellers in danger. The trunk of one which had fallen across the track measured 20 feet in circumference. Striking the Ituri, Mr. Lloyd followed that stream through an almost uninhabited wilderness, and, launching two canoes on the Aruwimi, floated down to the Congo, embarking on the river steamer at Basoko. Leopoldville was reached on November 24.

Dwarfs in the Interior of the Cameroons.—Although reports of a race of small stature in the interior of the Cameroons have been current for some years, no traveller had until last year been able to verify the rumour by his own observation. Quoting from the *Allgemeine Wissenschaftliche Berichte*, the *Deutsche Rundschau* (vol. xxi. No. 2) announces that the first accurate information respecting such a race was obtained last year by the Bulu expedition of the German military force. Seven individuals of the pygmy tribe were, after much difficulty, brought to the camp through the instrumentality of a native chief. Some of them showed traces of admixture with other tribes, but one woman, who seemed to possess the typical characters of the race, was carefully measured, and had a height of almost exactly 4 feet. The colour was a chocolate-brown to copperish, the palms of the hands alone being of a yellowish white. The hair was deep black, thick, and frizzled; the skull broad and high; the lips full and swollen. The mode of life seems to resemble that of other pygmy tribes, as they are very shy, wandering about from place to place, and avoiding frequented routes. They are skilled hunters, and collect much rubber, but dispose of it to other tribes for transport to the coast. Prof. Virchow, speaking of these people before the Berlin Anthropological Society in November last (*Deutsche Rundschau*, No. 4), said that, apart from their small size, they possess all the characters of true negroes, especially in their hair; and that, like the other pygmy tribes, they must be regarded as the remains of a primitive population, from which the various negro tribes have been derived.

The Re-organization of the Sudan.—The recent Anglo-Egyptian Convention regarding the government of the Sudan defines that region as all the territories south of 22° N. lat., whether never evacuated by Egypt since 1882, or temporarily lost and reconquered, already or in the future, by the British and Egyptian Governments. Both Wady Halfa and Suakin are thus included within its limits. For administrative purposes the region is divided into four first-class and three second-class districts, the former being Omdurman, Sennar, Kassala, and Fashoda. Omdurman district extends up the White Nile to Abu Hasa, and up the Blue Nile to Abu Harraz. Throughout the whole Sudan the British and Egyptian flags will be used together, except at Suakin, where the Egyptian flag alone will be used. The supreme military and civil command is vested in the governor-general.

AMERICA.

Report on Ports in the Province of Buenos Ayres.*—We have received the first part of an elaborate and exhaustive report by the engineer, Señor Julius B. Figueroa, on a survey undertaken to fix the best positions for commercial ports on the maritime and fluvial shores of the province of Buenos Ayres. This duty was entrusted by the Provincial Government to Señor Figueroa in May, 1895; and he now presents the first part of his important task in a report consisting of text and atlas, on five ports on the sea-coast, namely, the bay of San Clemente, Mar Chiquita, Mar del Plata, Necochea, and the estuary of Bahia Blanca. The report comprises, for each of these ports, a survey with theodolite, tidal observations, character of the bottom, observations on winds, currents, and waves, and information as regards access from the interior, building materials, water-supply, and fishery. The atlas contains detailed plans of the ports and anchorages, with soundings and tidal diagrams. Señor Figueroa is a young engineer, a native of Peru. He performed his work in a small vessel of ten tons and a four-oared boat. He certainly deserves commendation alike for his arduous work in surveying and sounding, and for the thorough and exhaustive way in which he has prepared and illustrated his report.

The Exploration of Western Patagonia.—The explorations carried out during the last few years in Western Patagonia, both from the side of Chili and Argentina, have followed each other so rapidly, that but a small proportion of the vast material collected has yet been published. One of the most active explorers of the region to the east of the Andes is, as is well known, Dr. F. P. Moreno, whose work, carried out early in 1896, was briefly referred to in the *Journal* for that year (vol. viii. p. 518). In view of the interest which attaches to the region in question by reason of the boundary dispute between Chili and the Argentine Republic, Dr. Moreno has published a preliminary account † of the explorations of 1896, in order to give his countrymen a clearer view than had yet been gained of the general nature of their Patagonian territory at the base of the Andes, and its economic possibilities. The journey referred to was but one out of a long series extending over nearly twenty years, undertaken by Dr. Moreno both as a private individual and as director of the *Musée de la Plata,* the results of which are still largely unpublished, but it possesses a special interest in connection with current questions. The bulk of the volume is devoted to a narrative of the course of the expedition, with abundant descriptions of the physical features and scenery of the country traversed. In the fifth chapter, which deals with the region of Lake Nahuel-Huapi, the author borrows the description from the unpublished record of his journey in 1880, which contains also some useful notes on early explorers in that region. Dr. Moreno likens the scenery to that of Switzerland on a larger and more imposing scale, but with the difference due to the absence of signs of human activity. In the concluding chapter, after summing up the geographical work accomplished in 1896, he sketches the proposals which have been made to open up the country by means of railways, the points of departure for which, on the Atlantic coast, would be Puerto San Antonio, a little south of the Rio Negro, and Tilly Road, just north of 46° S. He points out three different lines which might with advantage be made from the former port, one of which would extend to Lake Nahuel-Huapi. The author speaks highly of the agricultural capabilities of the country, especially around the latter lake, and thinks that on being thrown open to colonization, tract of 500 miles in length would be rapidly peopled. The work contains a series of excellent photographic illustrations, and a large map embracing the Andine region between about 39° and 47° S. lat. Another recent work, which adds to our knowledge of Western Patagonia, is Dr. Steffen's * account of the exploration of the Rios Puelo and Manso in 1895–96, also well provided with maps and illustrations. In addition to the narrative of the journeys, it contains a clear sketch of the physical geography of the Rio Puelo region, and an account of the botanical geography of the Rio Manso. Six different botanical regions are distinguished between the Pacific coast and the continental water-parting, which, here as elsewhere, lies considerably to the east of the main ranges.

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* 'Estudios sobre puertos en la provincia de Buenos Ayres.' I. Parte. La Costa Maritima, por El Enginiero Julio B. Figueroa (*La Plata*, 1897) (Ministerio de Obras Publias) Texto y Atlas.

† 'Musée de la Plata. Notes Préliminaires sur une Excursion aux territories du Neuquen, Rio Negro Chubut et Santa Cruz, effectuée sous la direction de Francisco P. Moreno.' La Plata, 1898.

The Glaciers of North America—Erratum.—In the *Journal* for December, 1898, p. 554, first line, *for* 579 *read* 579,000.

AUSTRALASIA AND OCEANIC ISLANDS.

Journey in Dutch New Guinea.—In the tenth number of *Petermanns Mitteilungen* for 1898, Herr E. St. Vráz gives a short account of a journey made at the end of 1896 in the north-west peninsula of New Guinea, the scene of the journeys of D'Albertis and Beccari twenty years previously. Herr St. Vráz was able to make his way farther into the interior than those travellers, but the illness of himself and his porters, and the suspicion of the natives, put many difficulties in his way and prevented the full realization of his plans. Landing first at the group of villages generally (but erroneously, according to Herr St. Vráz) known as Dore, the spot at which Wallace resided for a few months in 1858, the traveller afterwards proceeded to the mouth of the little river Andaj, and set out thence across the Arfak range for the headquarters of the Hatam tribe. Beyond the range, there over 4000 feet high, Herr St. Vráz reached a plateau 1000 feet above the sea, but sparsely covered with vegetation as compared with the coast and the Arfak range, and after crossing two other high ridges with excessively steep sides, which reminded him of the ascent of the Andes from the Huallaga, reached the first village of the Hatam people. Here two earthquake shocks were experienced. On the 6th day after leaving the coast, the traveller looked down into a valley, named by him D'Albertis valley, in which lies the village of Great Hatam, which had not been reached by previous travellers. The inhabitants who dwell on the mountain slopes, 6500 feet high, on both sides of the valley, differed in language, ornaments, etc., both from the coast people and the Arfakese, and Herr St. Vráz considers them an aboriginal population driven back from the coast towards the interior. The separate hamlets, which rarely contain more than twenty scattered huts, are generally placed high up on steep slopes. Beyond a range to the west-south-west, named by the traveller Beccari range, the country seemed to be uninhabited. Having advanced 12 miles beyond Great Hatam, Herr St. Vráz was obliged to retrace his steps, owing to the ill success of his efforts to obtain porters or supplies for the journey to a lake, the shores of which were said to be inhabited by a tribe named Manikioan, beyond which the Hiraj (cannibals) were said to live. He gives some details respecting the customs, etc., of the Hatam people, some of their usages being identical with those of the Guahibos and other Indians of South America. He laments the poverty of animal life of the district, owing to the persecution, which not only the birds of

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* 'Viajes i Estudios en la Rejion Hidrográfica del Rio Puelo.' Por Dr. Juan Steffen. Santiago, 1898.

Paradise, but every species of value, has experienced. For this reason his collections, the primary object of his journey, presented few novelties.

Tertiary elevated Limestone Reefs of Fiji.[*]—This subject is treated of by Dr. Alexander Agassiz in an article published in the *American Journal of Science* (4 ser., vol. vi. No. 32). A boring was started at Wailangilala island, in the atoll of the same name, and carried to a depth of 85 feet. For 40 feet coral sand was encountered similar to that forming the shores of the island; from that depth down to 85 feet, the core consisted of a limestone similar to the limestone composing the elevated reefs observed at Ngele Levu, Vanua Mbalavu, Mango, Yangasá, Oneata, Ongea, Kambara, Vatu Leile, and at different points along the eastern, southern, and western shores of Viti Levu. At some points the elevated limestones attain a height of over 1000 feet (Vatu Vara island, 1030 feet). The author points out that the Tertiary coralliferous limestones of Fiji have not played any part in the formation of the atolls or islands encircled by recent coral reefs, beyond forming the substratum upon which the recent corals have grown and established themselves as a comparatively thin crust. The underlying limestones have performed the same part as the volcanic substratum in other islands of Fiji. In both cases the platform upon the top of which the corals grow has been prepared by extensive submarine erosion.

POLAR REGIONS.

The Scientific Results of Nansen's Expedition.—We learn with pleasure that considerable progress has been made with the preparation, for publication, of the extensive scientific material collected during the voyage of the *Fram*, and that there is a likelihood that the first volume of memoirs will be issued during the coming summer or autumn. The collection will be in quarto form, and the separate memoirs will be the work of a number of specialists in the subjects treated of, each being paged separately. The total number will probably be about twenty, forming from three to five volumes. Those ready, or nearly ready, for the press include papers on the construction of the *Fram*, by Colin Archer; on the Jurassic fauna of Cape Flora, Franz Josef Land, by Dr. J. F. Pompeckj and Prof. A. G. Nathorst; on the ornithological results of the expedition, by Prof. R. Collett; and on the Crustacea collected, by Prof. O. G. Sars. Other important papers, not yet in so forward a state, will deal with different branches of marine zoology and botany, with the sediments of the ocean bottom, and the temperature and salinity of its waters at different depths; with the meteorological, magnetic, pendulum, and astronomical observations; with the formation and drift of the polar ice; while the geography of the north coast of Siberia will be illustrated by maps. Several of the papers will be by Dr. Nansen himself, while his collaborators include, besides those already mentioned, Prof. H. Mohn, Prof. Brögger, and others. The collection will be published at the expense of the Nansen Fund for the advancement of science.

The Voyage of the "Helgoland" round Spitsbergen.—At a meeting of the Berlin Geographical Society in November last, Captain Rüdiger, the commander of the *Helgoland*, gave an account of the German expedition which last summer visited the seas round Spitsbergen, and his paper is published in the *Verhandlungen* of the Society (1898, pp. 430 *et seq.*). The peculiarly favourable ice-conditions which prevailed during the latter part of July and the whole of August, while contributing to the success of the expedition, rendered navigation and geographical observation difficult by reason of the amount of fog caused by the evaporation from the open water; but, although the objects of the expedition were mainly zoological, some valuable geographical results were achieved, including many corrections of the delineation of the coasts of Spitsbergen. Leaving Tromsö on June 8, the voyagers sighted the southern end of Spitsbergen on the 16th, and made their way up Great Fiord, between Edge Land and West Spitsbergen. Heavy drift-ice was encountered, and, the passages leading to Olga strait being blocked, it was necessary to turn southwards and attempt to pass south of Edge Land. A great contrast was noticeable between the mountains of Spitsbergen, which, having their eastern slopes towards the voyagers, were entirely covered with snow and ice, and those of Edge Land, which, facing west, were already in great measure free from snow. The latter also differ in form, being generally table mountains. The existence of a tidal current in Walter Thymen strait was definitely proved, and it was also found that a current sets from Olga strait round the south end of Edge Land into Great Fiord, and thence round South Cape into the open sea to the west. It being found impossible to make a way through the ice into Olga strait, it was determined to first visit the west and north coasts of Spitsbergen, which proved to be in great measure free from ice. The *Helgoland* advanced as far as the Seven islands, but there encountered thick fogs and drift-ice, which prevented the continuance of the voyage eastward. In Great bay—between North cape and Cape Platen—the voyagers enjoyed splendid weather, the thermometer registering 52·7° Fahr. at noon. Captain Rüdiger says that Capes Platen and Wrede are placed too far north and east on the maps, Cape Platen being more to the south than North cape. The passage of Hinlopen strait as far as Cape Torell was effected without any difficulty, but ice then compelled a return. Soundings in the strait revealed a depth of 260 fathoms, which has not hitherto been shown on the maps. Returning round the west coasts of Spitsbergen, the *Helgoland* again reached (July 22) the south point of Edge Land, and the sea to the north-east was found to be entirely open. A course was accordingly shaped for the south point of Swedish Forland, but after passing over the position occupied by this on the maps, it was discovered that the island extends only half as far southwards as has been previously supposed. Jena island (the principal unit of King Karl's Land group) was also found to be smaller, and to lie in a more northerly position, than is shown on the maps; but Mr. Pike's assertion that there is no more land to the east was confirmed. The small island to the north-east of Jena island proved to be an important breeding-place of the ivory gull. Steaming along the shore of North-east Land, which presented an unbroken field of ice, the *Helgoland* reached Great island, which, as has been previously conjectured, lies 10′ farther north than is shown on the maps. It was now determined to push on through the ice, and attempt the circumnavigation of North-east land, which had never previously been accomplished in this direction. Dense fog rendered navigation difficult and dangerous, but the ship at last emerged into open water near Charles XII. island. Advancing northwards from the Seven islands, the expedition reached the edge of the pack in 81° 32′ N., soundings taken *en route* showing a rapid deepening of the sea, until at last no bottom could be found at 630 fathoms. The return voyage was made through Hinlopen and Olga straits.

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[*] See *ante*, *Geographical Journal*, vol. xii., 1898, p. 525.

A New Andrée Search Expedition.—It is announced from Copenhagen that Captain Daniell Brunn intends next summer to organize an expedition to search for Andrée and his companions along the east coast of Greenland. He proposes to make his way from Iceland by Jan Mayen to the neighbourhood of Cape Barclay, in about 69° N. lat.

GENERAL.

The Seventh International Geographical Congress.—A second circular relating to the proposed work of the International Congress to meet this year at Berlin, has been issued by the Acting Committee. It contains a statement of the subjects already offered for discussion, under the three heads: A. Papers, etc.; B. Propositions regarding unity of methods to be adopted by the different countries; C. Suggestions for joint international work. In view of the large number of subjects falling under the two latter heads, which will be brought before the Congress, it has been decided to appoint a scientific sub-committee for the examination of such propositions before they are embodied in the programme of the Congress. Those already submitted include propositions relating to the treatment of the problem of the tides, uniformity with regard to maps, the nomenclature of the oceans, etc., under the second heading; and for the joint collection of data respecting various geographical subjects, the exploration of the antarctic regions and of the oceans, the execution of the proposed map of the World and of a geographical bibliography, under the third. The Acting Committee call attention to the difficulty hitherto experienced in giving effect to resolutions of the Congress, and make an important suggestion with a view to a remedy. It is proposed that a Permanent International Committee shall be appointed to carry out, either alone or conjointly with the Bureau of the Congress, such measures as may be decided on at the general meeting, sub-committees being in each case entrusted with the practical work. Failing other means of providing funds, the governments of states might be applied to for financial assistance. The opinions and suggestions of members of the Congress on this subject are asked for, in order that a definite scheme may be laid before the Berlin meeting.

The Remains of Columbus.—After remaining undisturbed for hardly over a century, the remains of the great navigator have once more suffered removal, this time, it may be hoped, to their final resting-place. Transferred in 1509 from Valladolid to Seville, they were subsequently removed to San Domingo, only to be transferred to Cuba, on the cessation of Spanish rule in the former island. During the past hundred years they have remained at Havana, but since the Spanish evacuation of Cuba they have been brought back to Spain, arriving at Seville about the middle of January. After being landed from the despatch vessel *Giralda*, they were conveyed in state to the cathedral, the way being lined with troops, while salutes were fired and a requiem celebrated in the presence of an immense crowd.

Geographical Association.—The Annual Meeting of the Association was held on January 11, at the College of Preceptors, by permission of the Council, Mr. Douglas W. Freshfield, President of the Association, in the chair. The Annual Report, read by the Hon. Secretary, Mr. B. B. Dickinson (Rugby), gave evidence that the Association was growing steadily in numbers and influence. It stated that the Memorial to Boards of Public Examiners had been favourably received by the Central Welsh Board for Intermediate Education, and the answers from various examining bodies in Scotland expressed sympathy with the aims of the Association. In England the memorial was circulated two years ago, and has already led in several cases to a marked improvement in the character of the questions set. The question of a syllabus had been before the Committee for some years, and in December, 1897, two schemes of geographical work were drawn up and carefully considered by the Committee, who finally decided not to lend their authority to any syllabus, preferring to encourage individual teachers to explain in detail their own ideas of method, derived from practical experience. Several papers on the subject have since been published in the *Journal of School Geography* (New York), a monthly magazine which the Committee have done their best, during the past year, to make known to British teachers. Dr. A. J. Herbertson (Edinburgh) has been acting as Associate Editor for Great Britain, and various articles and notes by members of the Association have already appeared in its pages. Much, however, still remains to be done before the journal will meet the requirements of teachers in this country, and the Committee appeal for help in the work to all who are interested in geographical education. Reference was made to lectures given by members of the Committee during the past year; but in this direction also there is need for increased activity, to keep pace with the growing interest in geographical subjects that is felt throughout the country. In conclusion, the Committee expressed their regret at losing the services of the Rev. J. Ll. Dove, who has been one of their number since the Association was founded in 1893. They also tendered their thanks to the Councils of the Royal Geographical Society, the Royal Scottish Geographical Society, the Royal Colonial Institute, and the British Association for their continued support. The Treasurer's report showed an expenditure of £63 5*s.* 2*d.*, and a balance of £14 6*s.* 9*d.* In moving the adoption of the Report, Mr. A. D. Carlisle (Haileybury) spoke of the value to teachers of the Association's collection of lantern slides, to which large additions are now being made, as well as of the *Journal of School Geography*. The motion was seconded by Mr. H. J. Mackinder (Oxford and Reading), who expressed his satisfaction at the refusal of the Committee to issue an authoritative syllabus, which, however useful at the moment, could not fail to do harm later on. It was of the utmost importance that the Association should be kept as active and efficient as possible, and its numbers increased, for after the present period of educational organization there would come a time when the public would take an interest in educational ideals and methods as distinguished from machinery, and then would come the opportunity of this Association. The officers and committee for the present year were proposed by Mr. E. P. Ash (Haileybury), and seconded by the Rev. Dr. Field (Radley). The President, Mr. Douglas W. Freshfield, then delivered a short address. He referred to the efforts made by the Council of the Royal Geographical Society from 1884 to improve the teaching of geography. But the Society was mainly concerned with travel and exploration; hence the need for such an association as this. With regard to the *Journal of School Geography*, he remarked that co-operation with the United States was both pleasant and fashionable; yet we ought to have a journal of our own. The Committee had done wisely in deciding not to adopt a syllabus, for uniformity was alien to the English mind, and all our great schools had their own traditions. It must be the work of the Association to convert the head masters, the high priests of the old system; and he was glad to see at least one head master present who needed no conversion. Physical geography had been long neglected; he hoped it would not now be made too prominent, for many diagrams covered with little arrows were discouraging to small boys. Nor must they turn their maps into Joseph's coats, the colours smothering the physical features. In the case of the continents and great European countries, it was a good plan to place the physical map in an atlas opposite the political, so that they could be readily compared. They should not slavishly copy foreign methods, but the field excursions, so much in vogue on the continent, followed by mapping and modelling, might in some form be introduced; or, if that were not practicable, the boys might be taken on ideal journeys by means of maps and lantern slides, physical geography being used to throw light upon the facts of history, the position of famous cities, and the movements of population. He regretted that the establishment of a geographical school in connection with one of the great educational centres in London seemed to be, for the moment, postponed; but they must lose no chance of pressing it. Meantime, although no final scheme had, he understood, been definitely adopted, there was good hope that at their next meeting they might be able to congratulate themselves on geography having been put in its proper place in the University of Oxford. A vote of thanks to the chairman was moved by Dr. H. R. Mill, and seconded by the Rev. J. Ll. Dove. An exhibition of slides, specially selected to illustrate the use of the lantern in geographical teaching, was then given by Mr. A. W. Andrews, who in a few words indicated the special points that each slide was designed to illustrate.

Angelino Dalorto's Map of 1325.—A useful service to the history of cartography has been rendered by the publication, in facsimile, under the auspices of Prince Tommaso Corsini, owner of the original, of the map constructed in 1325 by the Italian cartographer, Angelino Dalorto. The reproduction of the map, which was presented to the Third Italian Geographical Congress held in connection with the centenary of Toscanelli and Vespucci, is accompanied by a short notice by Prof. A. Magnaghi, who had already given a short account of the cartographer in the *Revista Geografica Italiana* for 1897. He then considered the correct spelling of the name to be Dalorco, but recent researches of Prof. Marinelli and others have established Dalorto as more authentic. The family of that name was one of the most ancient of Genoa, and the names of its members frequently occur in the annals of the Italian commercial colony at Kaffa. The map is on parchment, measuring about 3½ feet by a little over 2. A legend at the side gives the name of the cartographer and the date, which has previously been misread as 1330. Although the information with regard to the coasts is particularly full and accurate, it does not seem to have been intended exclusively as a nautical chart, for the numerous data given with regard to the interior of the countries delineated entitle it to a place in the category of Mappamondi drawn to embody the state of accurate knowledge at the time with regard to the Earth. It includes the basin of the Mediterranean with the bordering countries, and a part of Northern and Western Europe. The cartographer keeps to the ancient conventional division of the continents, which he shows near the edge of the map by a circle divided into segments—the two western quadrants being occupied by Europe and Africa, and the eastern half by Asia. Explanatory notes define the extent of the three continents, Europe being held to terminate at the Don. In the representation of the interior of the land, Dalorto's map shows a great advance on those of his predecessors, and is one of the earliest maps in which attention is paid to the features both of the land and sea. As regards the coast-lines, the most remarkable advance is seen in the delineation of those of Northern Europe, in which Dalorto was long followed with little variation. Prof. Magnaghi calls attention to the most striking novelties to be seen in the map, and ends with the remark that it is one of the most precious cartographical relics of the Middle Ages. It is also of interest in connection with Baron Nordenskjöld's theory that the mediæval Portulani of the Mediterranean were all based on a type of *Catalan* origin. Prof. Marinelli adds a note upholding the claims of the Italian cartographers, and if, as Prof. Magnaghi holds, Dalorto was also the author of the Majorca map of 1339, usually known as that of Angelino Dulcert, the entire absence of examples of Catalan draughtsmanship previous to 1375 certainly seems to militate against Nordenskjöld's hypothesis.

Death of Victor Giraud.—The *Tour du Monde* (No. 49, 1898) records the death, on August 22 last, of Victor Giraud, the African explorer, which took place at Plombières, in the department of Vosges. The deceased traveller, who had only attained the age of forty years, was born at Morestel (Isère), and entered the French navy at an early age, being *enseigne de vaisseau* at the time of his well-known journey to the Central African Lakes (1882–84), the account of which he published in his work, 'Les Lacs de l'Afrique Equatoriale.' His most important achievement in this journey was the mapping—for the first time with any degree of accuracy—of Lake Bangweolo, the value of which has been fully shown by recent explorations. From the time of his return until his premature death, Giraud devoted himself to his professional duties.

Steamship Routes in the North Atlantic.—The rules framed by mutual agreement between the various Atlantic steamship companies for the better definition of the routes to be followed by westward and eastward bound vessels, came into force on January 15. From that date to August 14, west-bound vessels are to steer on a great circle course, but nothing south, so as to cross the meridian of 47° W. in lat. 42° N.; while from August 15 to January 14, the course must be shaped so as to cross 49° W. in 46° N., and 60° W. in 43° N. In either case they subsequently steer for a position south of Nantucket light-ship. East-bound ships must cross the meridian of 70° W., nothing to the northward of 40° 10′ N. at all times of year. From the intersection of those lines, a course is laid down which varies according to the time of year. From January 15 to August 23, the meridian of 47° W. is to be crossed in 41° N.; while from August 24 to January 14, the course passes the intersections of 60° W. with 42° N., and of 45° W. with 46° 30′ N. From the last positions in each case, nothing north of the great circle must be steered, whether bound to the Irish or English channels.

OBITUARY.

Captain Richard Trench Kirkpatrick, D.S.O.

The treacherous murder of Captain R. T. Kirkpatrick, D.S.O., one of the officers attached to Major Macdonald's expedition in East Africa, deprives the British authorities in those parts of the services of a young officer of much promise, who had likewise done good work in the interest of geographical knowledge. From the scanty details which have so far been received, it seems that the scene of the murder was somewhat to the east of Dufile, whence the sad news was sent by Major Macdonald on December 17. The deceased officer had left the main body of the expedition for surveying purposes. Captain Kirkpatrick, who belonged to the Leinster regiment, obtained his commission as lieutenant in 1885, and his captaincy in 1893. He joined our Society in 1897, and, on proceeding to East Africa, obtained a grant of instruments for surveys in that region. His exploration of Lake Kioja is referred to in the last volume of the *Journal* (p. 521).

CORRESPONDENCE.

Sebastian Cabot, 1508.

Sebastian Cabot, the earliest recorded English arctic explorer, visited the ice-bound seas in the years 1508–1509. No account of this voyage, nor of any voyage by Cabot during these years, is given by his English biographers. The grounds upon which the opening statement is established are described in the following paragraphs. If the arguments therein set forth are consistent with historical fact and with logical reasoning, the result is a definite addition to what is known about the earliest English maritime explorations.

English sailors made frequent trading voyages to Iceland during the last half of the fifteenth century. Some of them had doubtless been blown northward and westward beyond their destination. A few of these storm-tossed and wind-driven vessels may have succeeded in making their way back from polar seas, but if so, the tales of their adventures have not been preserved in written history. Exploring expeditions, moreover, had sailed westward from Bristol as early as 1480, and in 1497 a crew of Bristol sailors, commanded by the father of Sebastian Cabot, succeeded in reaching the North American continent. But, so far as can be made out from the available sources of information, the English voyage of 1508–9 was the first which deliberately sought a pathway through the unknown northern seas.

The career and the character of Sebastian Cabot have been studied with an amazing amount of well-intended energy during the past seventy years. Every scrap of information which concerns the man or his achievements have been examined with most exacting scrutiny. Laborious research has ransacked every storehouse wherein some chance might have hidden the least trifle of documentary information referring never so slightly to this subject. Whatever could be made to throw even the dimmest of side lights upon the world in which the Cabots lived, or upon the work which they did in it, has been utilized—from the galleys of Queen Hatshepsu to the latest charts of wind and tide and ocean currents. The students who have used these things, however, have been absorbed in contemplation of the fact that an Anglo-Venetian seaman may have set foot upon the continental soil of America a few weeks earlier than the Hispano-Genoese Columbus, or any other European of modern times. The definitive establishment of the fact that John, and not Sebastian, Cabot, in 1497, and not in 1494, planted an English banner on North America, was a notable historical performance. The proving of these facts required much wearisome research, careful and intelligent use of a confusing mass of material in many dialects, and a wide acquaintance with the literature and the characteristics of the period of discovery. It is now some years since the main facts of the Cabot discovery have been seriously questioned by well-informed and well-balanced students of that period. On the four-hundredth anniversary of the event, however, there was a sudden and remarkable revival of interest in everything connected with the discoverers. Books and many essays have been published, but it seems not to have occurred to the writers of these that there could be anything of real significance concealed in the known sources. The result has been that a great deal of time and of book-making has been expended upon the elucidation of facts which were already known quite as well, although not so widely, as they are to-day.

That the time is now ripe for some revision of the presuppositions which have hampered the students of Cabot, and for one addition to the stock of current information about him, seems to be shown by a remark in the latest volume devoted to the subject. Mr. Beazley, of Oxford, in his 'Builders of Greater Britain' volume, states in connection with one of the original accounts of Cabot's 1508 voyage that the story of this expedition "rests, to our thinking, on somewhat better foundation" than those of certain other voyages which some writers have supposed that Cabot made. Within the last half-dozen years, the story of this 1508 expedition has been partially related by two Italians. The erratic nature of many of the conclusions arrived at in the volume of one of these, however, and the evident desire of Sig. Tarducci to claim all honours for his hero, deprived his chapter upon this voyage of any convincing value. On the other hand, Dr. Errera, in the *Bollettino* of the Italian Geographical Society for August, 1893, presented certain facts which have been perfectly well known to all thorough students of the Cabots, in such a new arrangement as to make the voyage of 1508 seem quite possible. All of these facts, however, had previously been explained many times, with such different results, that no mere shuffling of them could be expected to change this possibility into an accepted historical probability. Moreover, the suggestions of Dr. Errera appear to be quite unknown to recent English writers upon the Cabots. Mr. Henry Harrisse probably represents the prevailing impression very fairly when, in his Cabot volume of 1896, p. 151, he describes one of the earliest distinct references to this voyage of 1508 as only "another example of the random talk noticeable in all the statements which originated with Sebastian Cabot."

The date of the voyage of 1508–9 is distinctly given by one of the best-known authorities for Cabot's English career, the writer whose works contain the earliest printed reference to him by name. Peter Martyr wrote his seventh decade, 'De Orbe Novo,' in 1524, and in the second chapter he mentions a voyage made by Cabot sixteen years before: "anno ab hinc sexto decimo ex Anglia." Unluckily, Richard Hakluyt corrected this statement, as he was entirely justified in doing according to his ideals of editorial duty, so that in the edition of the 'Decades' which he published in 1587, the edition which is almost invariably consulted by investigators, this passage reads, "Bacchalaos anno ab hinc vigesimo sexto ex Anglia per Cabotum repertos." Hakluyt's statement is the more nearly correct, according to what is now known regarding the Cabots' discovery of America. The important fact remains equally true, that Martyr, who knew Cabot intimately, associated his explorations with the year 1508.

This date is confirmed by a passage which was first made public by Sig. Berchet, in the monumental publication of the Italian Columbian Commission in 1893. Marc Antonio Contarini, in 1536, read to the Venetian Senate a report of his diplomatic mission to Spain, where he had enjoyed many opportunities of meeting Cabot. In this report, he states that Cabot made a voyage of exploration under the auspices of King Henry VII. of England, but that upon his return he found that his patron was dead, and that the son, Henry VIII., cared little for such enterprises. Henry VII. died on April 21, 1509.

The date of this voyage was comparatively widely known during the second half of the sixteenth century. In 1578, George Beste described a Cabot voyage of 1508, with considerable detail, in his 'Trve Discovrse of the late Voyage of Discoverie, for the finding of a passage to Cathaya by the North-vvest.' A year later, at Geneva, Vrbain Chauveton published a French translation of Benzons's 'New World,' to which he made extensive additions, including an account of Cabot's voyage, dated 1507, with details which were evidently not derived from Beste, nor yet from Ramusio's *Summario* of Peter Martyr, to which it apparently gives a reference. Chauveton's additions were translated into Latin and German for De Bry's edition of Benzoni, in his 'Grand Voyages,' part iv.

The more important details of this voyage are contained in the report, already mentioned, delivered to the Venetian Senate by Marc Antonio Contarini. The ambassador states that Cabot was authorized by Henry VII. to take two ships, and that "with three hundred men he sailed so far that he found the sea frozen, and he was compelled to return without having accomplished his object." As Mr. Harrisse has pointed out, this account agrees closely with an undated narrative printed in 1516 by Peter Martyr, and derived directly from Cabot, who was a frequent guest at Martyr's table. Martyr states that the northern seas had been searched by Sebastian Cabot, who fitted out two ships with three hundred men in England, and sailed northwards until he found immense icebergs and continual daylight in the month of July. He succeeded in making land, from which the sun had melted the snow. Compelled by the obstacles of nature to turn back, he coasted southwards, meeting immense shoals of large fish, whose countless masses actually stayed the progress of his vessels. Along the shores large bears were observed, which lay in wait for the fish, leaping into the shallow water as they saw their chance, and drawing the prey to land after much spattering and struggling. Another account of these fish and bears, much more realistic than that published by Martyr, is contained in the perplexing *Summario* of the 'Decades' and other earliest treatises on the 'New World,' which was printed in Venice in 1534. Curiously enough, this very significant narrative has never been used to any serious purpose by the biographers of Cabot, for what reason it would be hard to say.

Gomara in 1552, and Galvano in 1563, placed on record the main facts connected with this voyage, but without additional details, except the degree of north latitude reached, which is given as 58° or 60°. These facts are verified, also, to a certain extent by Richard Eden, whose intimacy with Cabot in his later years has been so often portrayed. In a comment on a translation of one of these narratives, Eden remarks that "Cabot touched only in the north corner and most barbarous parte" of the new world, "from whence he was repulsed with Ise in the moneth of July."

Sebastian Cabot made another attempt, beside the voyage of 1508–9, to find a route through the northern seas. The details of this expedition cannot be made to coincide at any point with those already quoted. The most circumstantial account of this voyage is given by Ramusio, to whom had been entrusted, in 1551, an investigation into Cabot's Venetian interests. In the Discorso prefixed to the third volume of his 'Collection of Voyages,' published in 1553, Ramusio mentions a letter written to him by Cabot some time before, in regard to the probabilities for a worth-west passage from Europe to the East. Cabot wrote that he had once sailed for a long time west and north, until he reached lat. 67½° on June 11. The sea was still open before him, and there seemed to be nothing to prevent him from proceeding onwards toward Cathay, when he was forced to stop and turn back on account of some trouble with the shipmaster and mutinous sailors—"la malignità del padrone & de marinari solleuti."

There are two other accounts of an English voyage made at about this time, which was interfered with by a mutiny of the seamen. One is in the fascinating 'Interlude of the iiij Elements,' which, describing America, tells how—

"But yet not longe a go
Some men of this countrey went
By the Kynges noble consent
It for to serche to that extent
And coude not be brought therto.
But they that were the venteres
Haue cause to curse their maryners
Fals of promys and dissemblers
That falsly them betrayed.
Which wold take no paine to saile farther
Than their own lyst and pleasure."

Richard Eden, of whose intercourse with Cabot we have such abundant traces, presented his translation of Munster's 'Treatyse of the Newe India' to the Duke of Northumberland. In the dedicatory epistle, Eden says that "manlye courage, if it had not been wanting in others, at suche tyme as oure sovereigne lorde of noble memorie King Henry the viij. about the same year of his rayne, furnished & set forth certen shippes under the gouernaunce of Sebastian Cabot, yet living, and one Syr Thomas Perte, whose faynt heart was the cause that that viage toke none effect." This passage closely suggests a remark made by Robert Thorne in a "book" or letter written about 1527, which is printed in Hakluyt's 'Divers Voyages.' Referring to some undertakings of the Bristol merchants, his father and Hugh Eliot, he says that "if the mariners woulde then haue been ruled, and folowed their pilots mind, the lands of the West Indies, from whence all the gold commeth, had been ours." In a marginal note, Hakluyt refers to Cabot's letter to Ramusio, which is quoted above.

No convincing indication of the date of this voyage has yet been discovered. Chauveton, as previously noted, tells of a voyage by Cabot to 67° north in 1507. The date 1517 would seem at first sight to be implied by Eden, were it not for the fact that this writer was far too serious and too sensible a student to juggle with words in the fashion needed to obtain the eighth year of Henry VIII. There are many reasons for doubting the possibility of an English voyage having been made by Cabot in 1517, and Mr. Harrisse has devoted much skilful research to proving that Sir Thomas Perte or Spert could hardly have engaged in it at that time. Dr. Errera argues that in English, as in Italian, "the same year" of Henry VIII., in the absence of a direct reference to any other time, is obviously the first year of the reign. By this interpretation, the events of the mutinous voyage are combined with those of the iceberg expedition of 1508-9. An open sea at 67° north on June 11, and icebergs in July at 60°, are by no means mutually impossible. The two narratives are, however, so clearly distinguishable in all other respects, that it seems much safer to consider them as referring to separate adventures, and frankly to confess that there is no available means of determining the date of the June voyage to 67° north, unless we accept Chauveton's 1507, for which the most that can be said is that it has not been disproved.

Why has so little attention hitherto been paid to these two Cabot arctic voyages? In August, 1497, John Cabot and his English shipmates landed at Bristol, bringing the news that there were fertile lands awaiting Christian colonization on the western side of the Atlantic. Plans for the further exploration of this newly found land quickly took shape, and there is the best of evidence that five ships started thither early in the following year, 1498, equipped with everything that might be needed for the settlement of a colony and the exploitation of the country. Of the failure of this expedition—for in this case no news is probably not good news—absolutely nothing is known to-day. Not one word exists which has been proven to refer to the progress of the ships after they encountered a storm which forced one of them to return to the Irish coast. Perhaps it is one consequence of this absence of other information, that it has been the custom of writers upon the Cabot voyages to assume that the several narratives of arctic voyages, which have been quoted in previous paragraphs, contain the record of the progress of the expedition of 1498. The most painstaking examination of the original texts of these narratives, and of the context in which they properly belong, does not reveal the slightest ground for any such assumption.

It is not known whether Sebastian Cabot accompanied either of the expeditions of 1497 or 1498. After his father's death, according to the statements of men who knew him well, and whose good faith and historical competency in other matters are not questioned by those who have studied their writings most carefully, Sebastian became animated with a desire to emulate the achievements of Columbus. That source of winning the confidence and the support of those with whom he came in contact which characterized Sebastian Cabot so strikingly throughout his career, doubtless helped him at its very beginning to persuade King Henry VII. to authorize a trial of his ideas on navigation. In 1500, as in 1900, the thoughts of British merchants centred on the markets of Eastern Asia. Cabot, so far as we are able to understand his ideas, believed, and correctly, that the shortest route from England to Cathay lay across the arctic circle. He seems also to have had some notion of what is now called "great circle sailing," and this was probably the idea which he put on trial during the last year of his patron's life. Whether he had previously made a trial of the same theory, only to be thwarted by those with whom he sailed, is not now known.

Two facts must be explained before this hypothetical sketch of Sebastian Cabot's early career can claim the support of historical students. The first is, that the Drapers' Company of London in 1521 declared that a certain Sebastian—apparently referring to Cabot—had never visited the lands to which Henry VIII. was then proposing to send him as pilot of an expedition. It is not probable that the lands upon which Henry VIII. and Cardinal Wolsey were thinking of expending men and treasure lay in the neighbourhood of those arctic regions which Cabot is supposed to have visited. Not one of the extant reports of his American exploration, for which Sebastian can be in any way held to be personally responsible, lays claim to acquaintance with any portion of the new world except the most northern regions.

The other fact is that, as has been persistently alleged, Sebastian Cabot throughout his life always confused his own arctic explorations with the discovery of the new-found land of Bacchalaos, and that he rarely, if ever, referred to the exploits of his father. There would be greater difficulty in refuting this allegation were it not for the actual fact that there are only two clear references to the discovery of 1497 which can be traced directly to Sebastian, and that each of these credits the discovery to his father. The mappemonde presumably made by Sebastian Cabot in 1544, and the Harford, pseudo-Holbein, portrait of the son, both state that John Cabot discovered North America. Each, at least by implication, leaves the impression on the reader that the son participated in that discovery. There exists not the slightest ground upon which to base an absolute denial of the truth of this last statement.

As for the other accounts, Sebastian must have talked with many people many times about his early English experiences. His hearers were mainly interested in two things—the discovery of Baccalaos, or the codfish country, which was first visited by a European within the period of modern history, when John Cabot touched its shores in 1497; and in Sebastian's tales of his own seafaring. Some of his listeners repeated his stories, and we know that their words were retold to others. Small wonder that confusion crept into the narrative; that the father who had died a half-century before was forgotten in the son, whose courteous, intelligent earnestness made him friends among the stolid Englishmen as among the mercurial Spaniards; and that the events of voyages accomplished many decades earlier mingled together to form a single narrative. Conversation rarely fixes any fact clearly in the mind; it leaves many impressions which are true, but which are quite as easily recalled, as every lawyer knows, in false as in their true associations. This, however, is not a place for the discussion of historical evidence, or of the character of Sebastian Cabot. It is not out of place, however, to suggest that the historical sources which detail the story of the Cabots, are in no wise different from those which relate to other men, living or dead, and that the rules of historical criticism which need to be applied in their elucidation are the same as are used in other investigations. Recent developments in the Cabotian controversies make it necessary to preserve in their discussion, with rather more than usual care, the spirit of fair play and honest open-mindedness, and to employ a certain amount of common sense—and very little else.

George Parker Winship.

Providence, R.I., November 30, 1898.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria. ———

Hydrographischer Dienst in Österreich. Jahrbuch des k. k. hydrographischen Central-Bureaus. IV. Jahrgang 1896. Wien: W. Braumüller, 1898. Size 15 × 11. *Maps and Diagrams.*

Statistics, diagrams, and maps of rainfall, snowfall, and river-levels in the drainage areas of all the rivers of the Austrian crown-lands separately, and a general section giving the necessary explanations and general statistics.

Balkan States. **Miller.**

Travels and Politics in the Near East. By William Miller. London: T. Fisher Unwin, 1898. Size 9½ × 6½, pp. xxiv. and 516. *Map and Illustrations. Price* 21*s.*

This book records the journeys of a careful, observant, and well-instructed traveller through the greater part of the Balkan peninsula. Chapters are devoted to Istria and Dalmatia, Montenegro, Bosnia and Herzegovina, Novibazar, the Albanian coast and Corfu, Greece, Crete, Samos, Macedonia, Constantinople, and Bulgaria. There are excellent illustrations, including a striking view of the Corinth canal. A reprint of Kiepert's map of the Balkan peninsula (uncoloured), on the scale of 1 : 1,500,000, is reproduced by permission, but neither the name of the author nor of the German publisher, Dietrich Reimer, is mentioned upon it.

France—Mont Blanc. **Mathews.**

The Annals of Mont Blanc. A Monograph. By Charles Edward Mathews. With a Chapter on the Geology of the Mountain, by Prof. T. G. Bonney. London: T. Fisher Unwin, 1898. Size 9 × 6, pp. xxiv. and 368. *Map and Illustrations. Price* 21*s. Presented by the Publisher.*

This important history of the ascents of Mont Blanc is accompanied by a chapter on the geology of Mont Blanc by Prof. Bonney, and a bibliography of the mountain arranged alphabetically according to authors' names. The appendix includes a table of all the ascents from 1786 to 1851, a table of fatal accidents from 1820 to 1898—these number 19—and a facsimile reprint of an interesting 'Account of the Glacières or Ice Alps in Savoy,' presented to the Royal Society in 1744.

Italy. **Corcelle.**

Turin et la Vallée d'Aoste. Par J. Corcelle. (Extrait de la *Revue de Géographie*, Octobre 1898.) Size 10 × 6½, pp. 8. *Presented by the Author.*

Italy. **Magistris.**

Giovanni Marinelli. Le Provincie d'Italia. Brevi cenni geografici, statistici e storici per lo studio della geografia patria nelle scuole elementari secondo i programmi 29 novembre 1894. Provincia di Aquila degli Abruzzi di Luigi Filippo de Magistris. Roma: Società Editrice Dante Alighieri, 1898. Size 8 × 5½, pp. (each) 24. *Presented by the Author.*

Italy—Graian Alps. *Jahrb. Schweizer Alpenclub* **33** (1897–98): 101–148. **Euringer.**
Die Grajischen Alpen. Zweiter Teil. Bergfahrten in Piemont. Von Gustav Euringer. *With Plates.*

Italy—Lago di Garda. *Riv. G. Italiana* **5** (1898): 365–377. **Fischer.**
L'anfiteatro morenico del Lago di Garda. Del Prof. Dott. Teobaldo Fischer.

Russia. *B.A. Imp. Sci. St. Pétersbourg* **8** (1898): 77–84. **Dubinsky.**
Détermination des éléments du magnétisme terrestre à Kamenets-Podolsk, Khotine et Odessa en automne 1895. Par W. Dubinsky. [In Russian.] *With Plate.*

Russia. *Mém. Comité Géolog. Russ.* **16** (1898): 1–362. **Stuckenberg.**
Allgemeine geologische Karte von Russland. Blatt 127. Von A. Stuckenberg. [In Russian.] *With Plates.*

This report is in Russian, with a comprehensive abstract in German.

Russia. *G.Z.* **4** (1898): 556–573. **Gotz.**
Die Industriegebiete des östlichen und nördlichen Russlands. Von Wilh. Götz.

Russia. *J. Franklin I.* **146** (1898): 193–214, 264–279. **Kunz.**
A Trip to Russia and the Ural Mountains. By George F. Kunz.

Russia—Cyclones. *B.A. Imp. Sci. St. Pétersbourg* **7** (1897): 481–485. **Rybkin.**
Die Cyclonenbahnen in Russland in den Jahren 1890–92. Vorläufige Mittheilung. Von P. Rybkin.

Notes on the paths of 344 cyclones which pursued a well-marked path across European Russia.

Russia—Geology. **Nikitin.**
Bibliothèque Géologique de la Russie. 1896. Composée sous la rédaction de S. Nikitin. Supplément au tome xvi. des Bulletins du Comité Géologique. St. Petersburg: Eggers & Cie., 1897. Size 10 × 7, pp. 244.

This book is printed in Russian, with a French translation of each title and brief summary of works dealing with the geology of Russia.

Russia—Kursk. *Mém.* [*Zap.*] *S. Imp. Russe G.* **32** (1898): 1–24. **Moureaux.**
Déterminations magnétiques faites en Russie dans le Gouvernement de Koursk sous les auspices de la Société Impériale Russe de Géographie en 1896. Par M. Th. Moureaux. *With Maps.*

Russia—North Coast. *Petermanns M.* **44** (1898): 230–231. **Shokalsky.**
Die Arbeiten der Russischen Kriegsmarine in den arktischen Gewässern im Jahre 1896. Mitteilung von J. v. Schokalski. *With Map.*

A summary of the work by Colonel Shokalsky, of which a translation appeared in the *Journal* for August, 1898 (vol. xii. p. 172).

Switzerland. *B.S.G. Lille* **30** (1898): 129–148. **Maquet.**
La Haute-Engadine et le massif de la Bernina. Par M. Maurice Maquet. *With Illustrations.*

Switzerland—Bern. *XVI. Jahresb. G. Ges. Bern* 1897 (1898): 261–266. **Schmid.**
Die Temperaturverhältnisse in der Aare bei Bern. Von Emil Schmid.

The temperature of the water of the Aar has been observed three times daily since 1895, and the results for three years are briefly discussed.

Switzerland—Bernese Alps. **Gallet.**
Jahrb. Schweizer Alpenclub **33** (1897–98): 173–191.
Quelques chemins inédits dans les Alpes bernoises. Par Julien Gallet. *With Plates.*

Switzerland—Davos. *Jahrb. Schweizer Alpenclub* **33** (1897–98): 262–291. **Schibler.**
Ueber die nivale Flora der Landschaft Davos. Von Dr. Wilh. Schibler. *With Plates.*

On the high mountain flora of the Davos region.

Switzerland—Geodesy. **Messerschmitt.**
Internationale Erdmessung. Das Schweizerische Dreiecknetz herausgegeben von der Schweizerischen geodätischen Kommission. Achter Band. Lotabweichungen

in der mittleren und nördlichen Schweiz. Im Auftrage ausgeführt und bearbeitet von Dr. J. B. Messerschmitt. Zürich: Fäsi & Beer, 1898. Size 12½ × 9, pp. vi. and 204. *Plate.*

On the geodetic results of the Swiss triangulation.

Switzerland—Rhone Glacier. *C. Rd.* **127** (1898): 572–574. **Forel.**
Circulation des eaux dans le glacier du Rhône. Note de M. F. A. Forel.

United Kingdom. *J. of T. Victoria I.* (*London*) **30** (1898): 305–323. **Hull.**
Further investigations regarding the Submerged Terraces and River Valleys bordering the British Isles. By Prof. Edward Hull, LL.D., F.R.S. *With Chart.*

United Kingdom. *Nineteenth Century* **44** (1898): 840–853. **Paley.**
The Roman Roads of Britain. By W. B. Paley. *With Map.*

United Kindom—Agriculture. *P. Philosoph. S. Glasgow* **29** (1898): 1–21. **Smart.**
The Report of the Royal Commission on Agricultural Depression. By William Smart, M.A.

United Kingdom—Emigration and Immigration. ———
Copy of Statistical Tables relating to Emigration and Immigration from and into the United Kingdom in the year 1897, and Report to the Board of Trade thereon. London: Eyre & Spottiswoode, 1898. Size 13 × 8½, pp. 62. *Price 6d.*

In 1897 the number of passengers leaving British ports was 782,430, and those arriving, 742,114—a balance of 40,316 outwards, which is a smaller number than for several previous years. The British and Irish emigrants numbered 146,460. Tables of the emigration for previous years and of the emigration from the separate ports are also given.

United Kingdom—England—Derbyshire. ———
Report by the Board of Agriculture upon an Application for a Provisional Order for the Regulation of Wolstanton Marsh, Staffordshire. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. 4. *Price ½d.*

United Kingdom—England. **Fairley.**
On the Water Supplies of Yorkshire. By Thomas Fairley. Reprinted from the *Journal of the Federated Institutes of Brewing*, vol. iv., No. 5, May, 1898. Size 8½ × 5½, pp. 393–406. *Map. Presented by the Author.*

The water available for supplying towns in Yorkshire is here classified according to the amount of dissolved salts it contains, the smallest quantity of total salts noted is 4·16 grains per gallon at Pickering, the largest—not a mineral water—is 48·9 near Middlesbrough.

United Kingdom—England. **Mossman.**
Quarterly J.R. Meteorolog. S. **24** (1898): 238–249.
On the Frequency of Non-Instrumental Meteorological Phenomena in London with different winds from 1763–1897. By R. C. Mossman.

The discussion shows that snow comes most frequently with north and east winds, hail with west and north-west winds, strong gales from west or south, summer thunderstorms most often from quarters between east and south or else west, dense fog almost always with east wind, and auroras usually with south or west winds.

United Kingdom—England. **Bosworth.**
Philips' County Readers, Essex Past and Present. By George F. Bosworth. London: G. Philip & Son, 1898. Size 7½ × 4½, pp. x. and 240. *Maps and Illustrations. Price 2s. Presented by the Publishers.*

This little book gives a series of extracts and descriptions by many writers, illustrated by an orographical and a geological map and various pictures, which together give a good popular idea of the individuality of Essex as a geographical and historical unit.

United Kingdom—England. *J. School G.* **2** (1898): 291–297. **Mill.**
The English Lake District. By Dr. H. R. Mill.

United Kingdom—Ireland. *Natural Sci.* **13** (1898): 243–252. **Fitzpatrick.**
The Eskers of Ireland. (Part ii.) By Thos. Fitzpatrick, LL.D.

United Kingdom—Meteorology. **Scott.**
Quarterly J. R. Meteorolog. S. **24** (1898): 217–228.

The frequency of Rainy Days in the British Islands. By Robert H. Scott, M.A., F.R.S. *With Maps.*

The largest number of rainy days for the ten years 1886–1895 was found to be 72 per cent. for Stornoway, and nearly as much for stations in the west of Ireland and Shetland. Less than 50 per cent. of the days brought rain over the south-east of Scotland and the centre of England over a roughly rectangular area, with Chester and the Humber on the north, and the coast from Torquay to Dover on the south. The smallest rain-frequency reported was 39 per cent. at Bude, in Cornwall, but this must be explained by peculiar local conditions.

White Sea. *B.A. Imp. Sci. St. Pétersbourg* 7 (1897): 269–301. **Knipovich.**

Matériaux concernant l'hydrologie de la Mer Blanche et de la Mer Mourmane I. Par N. Knipovitch. [In Russian.]

ASIA.

China. **Bretschneider.**

History of European Botanical Discoveries in China. By E. Bretschneider, M.D. 2 vols. London: Low & Co., 1898. Size 11 × 8, pp. xvi. and 1168. *Presented by the Author.*

Dr. Bretschneider has planned this important work in such a way as to present a history of scientific exploration and observations in China, although the subjects dealt with are the plants and vegetable products only. The arrangement is chronological, commencing with the journeys of Marco Polo, but becoming detailed and important with the work of the Jesuit missionaries of the sixteenth century, and from the beginning of the nineteenth century, detailing the results of every expedition or traveller. The latest data refer to 1898. There is an admirable index of species.

India—Nepal. *Imp. and Asiatic Quarterly Rev.* 7 (1899): 64–82. **Parker.**

Nepaul and China. By E. H. Parker.

On the former relations existing between Nepal and the Chinese empire, treated historically, and of the wars between the Chinese and Ghurkas, largely from Chinese sources. The author asks for the co-operation of any one knowing many place-names in Nepal, or possessing a good map of it, in order to continue with more result his studies of the Chinese records.

Japan. **Diósy.**

The New Far East. By Arthur Diósy. With Twelve Illustrations from special designs by Kubota Beisen, of Tōkio, a Reproduction of a Cartoon designed by H.M. the German Emperor, and a specially drawn Map. London: Cassell & Co., 1898. Size 9 × 6, pp. xvi. and 374. *Price* 16*s.*

Malay Archipelago—Borneo. **Agamennone.**
Atti R.A. Lincei, Rendiconti 7 (1898): 155–162.

I terremoti nell' isola di Labuan (Borneo) del 21 settembre 1897. Nota di G. Agamennone.

On the earthquake at Labuan on September 21, 1897.

Malay Archipelago—Natuna Island. **Hassett and Schwartz.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **15** (1898): 21, 154, 444, 657.

De Poelau Toedjoeh in het zuidelijk gedeelte der Chineesche Zee. Door A. L. van Hassett en H. J. E. F. Schwartz. *With Map and Illustrations.*

Malay Archipelago—Philippines. **Brinton.**

The Peoples of the Philippines. By Daniel G. Brinton, M.D. Reprinted from the *American Anthropologist*, October, 1898. Washington, 1898. Size 10 × 6½, pp. [16]. *Map and Illustrations. Presented by the Author.*

Malay Peninsula—Pahang. **Clifford.**

Annual Report of the State of Pahang for the year 1897. By Hugh Clifford. Kuala Lumpur, 1897. Size 13½ × 8½, pp. 36. *Presented by the Author.*

Malay Peninsula—Perak. **Rodger.**

Perak Administration Report for the year 1897. By J. P. Rodger. Taiping. Size 13½ × 8½, pp. 54.

Persia. *J. Manchester G.S.* **14** (1898): 176–189. **Wells.**

Caravan Routes and Road Making in Persia. By Lieut.-Colonel Henry Lake Wells. *With Map.*

Philippine Islands. *Deutsche Rundschau G.* **21** (1898): 1–12. **Le Monnier.**

Der Archipel der Philippinen. Von Dr. Franz Ritter v. Le Monnier. *With Map and Illustration.*

Philippine Islands—Manila. **Stevens.**

Yesterdays in the Philippines. By Joseph Earle Stevens. London: Low & Co., 1898. Size 8 × 5½, pp. xx. and 232. *Map and Illustrations. Price 7s. 6d. Presented by the Publishers.*

A popularly written sketch of life in Manila, by the representative of the one American firm which existed there before the war.

Russia—Caucasus. *Blackwood's Mag.* **164** (1898): 524–541. **Simpson.**

Travel Pictures in the Caucasus. By J. Y. Simpson.

Russia and Persia. **Radde.**

Wissenschaftliche Ergebnisse der im Jahre 1886 allerhöchst befohlenen Expedition nach Transkaspien und Nord-Chorassan. Von Dr. G. Radde.—Dr. A. Petermanns Mitteilungen Ergänzungsheft Nr. 126. Gotha: Justus Perthes, 1898. Size 11 × 8, pp. 196. *Map.*

This is the full report of a number of journeys carried out in the Trans-Caspian territory and in northern Khorasan between 1881 and 1886 by Dr. Radde and J. M. Konshin, and contains an immense amount of information as to the topography, geology, and physical geography of the region.

Russia—Siberia. *Globus* **74** (1898): 287–291. **Fedoroff and Kondratovich.**

Eine Ob-Expedition während des Sommers 1895. Nach G. G. Fedorow und O. W. Kondratowitsch.

Russia—Siberia. *Rev. G.* **42** (1898): 199, 266; **43** (1898): 99, 180. **Radlinski.**

Les peuplades du nord-est de l'Asie. Par I. Radlinski.

Russia—Siberia. ———

Le Transsibérien et les Excursions en Train de Luxe organisées par la Cie Internationale des Wagons-lits et des grands Express Européens. Paris: Imp. Lahure. Size 6¾ × 10, pp. 28. *Map and Illustrations.*

Russia—Siberia. *Globus* **74** (1898): 193–194. **Pech.**

Kap "Deshnew," bisher "Ostkap," und sein Entdecker. Von T. Pech.

The Russian Emperor having decreed on June 18 (30), 1898, that East Cape, the easternmost promontory of Asia, should henceforth be called Cape Deshneff, in honour of its discoverer, the paper recalls the circumstances of the original journey in 1648.

Russian Central Asia. **Perowne.**

Russian Hosts and English Guests in Central Asia. By J. T. Woolrych Perowne. London: The Scientific Press, 1898. Size 9 × 6, pp. xvi. and 198. *Map and Illustrations. Price 7s. 6d. Presented by the Publishers.*

The author in his preface states that he has in this book "purposely avoided any attempt to make a volume that should bring up to date our knowledge of the geographical, commercial, or political aspect of the countries" he visited. The journey is described as one of great comfort and enjoyment, and the illustrations are characteristic and numerous. The route followed was that of the Trans-Caucasus and Trans-Caspian railways, from Batum to Samarcand, with trips thence into Ferghana and to Tashkent. The spelling of place-names and transliterations from Russian do not follow a uniform system.

Siam. **Beckett.**

Trade of Chiengmai and District for the year 1897. Foreign Office, Annual No. 2192, 1898. Size 10 × 6½, pp. 16. *Price 1d.*

Turkey—Anatolia. **Diest.**

Von Tilsit nach Angora. Forschungsreise zweier preussischen Stabsoffiziere im Frühjahr 1896. Von Walther v. Diest.—Dr. A. Pettermanns Mitteilungen. Ergänzungsheft Nr. 125. Gotha: Justus Perthes, 1898. Size 11 × 7½, pp. 98. *Maps.*

Turkey—Asia Minor. *Sitz. k. Preussische A. W. Berlin* (1898): 531–555. **Judeich.**

Bericht über eine Reise im nordwestlichen Kleinasien. Von Prof. Dr. Walther Judeich. *With Illustrations.*

Turkey—Palestine. **Hanauer.**

Palestine Exploration Fund, Quarterly Statement (1898): 244–246.

Tell er Reesh, etc. By Rev. J. E. Hanauer. *With Map.*

On a hill in the neighbourhood of Jaffa.

Turkey—Palestine. **Schick.**
Palestine Exploration Fund, Quarterly Statement (1898): 224–229.
Birket es Sultan, Jerusalem. By Dr. Conrad Schick. *With Plan and Section.*

Turkey—Palestine. **Schick.**
Palestine Exploration Fund, Quarterly Statement (1898): 232–238.
Hebron and its Neighbourhood. By Dr. Conrad Schick. *With Plan.*

Turkey—Palestine and Syria. **Baedeker.**
Palestine and Syria. Handbook for Travellers, edited by Karl Baedeker. With 20 Maps, 48 Plans, and a Panorama of Jerusalem. Third Edition. Leipsic: Karl Baedeker; London: Dulau & Co., 1898. Size 6½ × 4½, pp. cxviii. and 472. *Price* 12 *marks. Presented by Messrs. Dulau & Co.*

This handbook is written by Dr. Albert Socin, and revised from the recent journeys of Dr. Immanuel Benzinger.

AFRICA.

Congo State. **Burrows.**
The Land of the Pigmies. By Captain Guy Burrows. With Introduction by H. M. Stanley, M.P. London: C. Arthur Pearson, Ltd., 1898. Size 9 × 6, pp. xxx. and 300. *Portrait and Illustrations. Price* 21*s. Presented by the Publishers.*

Mr. Stanley, in his preface, pays a tribute to the Belgian administration of the Congo State. Captain Burrows relates his journeys and observations in the Welle district, in some parts of which he was the first European to set foot. The King of the Belgians adds a letter apparently addressed to "the agents of the Congo Free State," but not dated. There are numerous illustrations, some of them remarkably interesting, but neither maps nor index. The spelling of place-names is unusual.

Marocco. **Schnell and Bernard.**
Publication de l'École des Lettres d'Alger. Bulletin de Correspondance Africaine. L'Atlas Marocain d'après les documents originaux. Par Paul Schnell. Traduit . . . par Augustin Bernard. Paris: E. Leroux, 1898. Size 10 × 7, pp. x. and 316. *Map. Presented by M. A. Bernard.*

M. Augustin Bernard, professor of African geography in the École supérieure des Lettres in Algiers, has translated the valuable monograph compiled by Dr. Paul Schnell, and published as an Ergänzungsheft of *Petermanns Mitteilungen* in 1892; the text of the translation having been revised by the author, who has brought the work down to date, the translator assisting in this task. The result will be to ensure an enlarged circle of readers for a most deserving work.

Tripoli. *Deutsche G. Blätter* **21** (1898): 88–110. **Grothe.**
Tripolitanien und der Karawanenhandel nach dem Sudan. Von Dr. L. H. Grothe.

Tripoli. *G.Z.* **4** (1898): 537–556. **Grothe.**
Tripolitanien und seine Zukunft als Wirtschaftsgebiet. Von Dr. L. H. Grothe. *With Plates.*

A summary of the geography of Tripoli based on a residence of two years in different parts of the territory, concluding with a statement of the belief that Germany is the European nation called upon to open up Tripoli to civilization and trade.

Tunisia. **Bruun.**
The Cave Dwellers of Southern Tunisia. Recollections of a Sojourn with the Khalifa of Matmata. Translated from the Danish of Daniel Bruun, by L. A. E. B. London: W. Thacker & Co., 1898. Size 9½ × 6, pp. xii. and 336. *Illustrations. Price* 12*s. Presented by the Publishers.*

This is the record of a journey in the interior of Tunisia for the collection of ethnographical specimens for the museum in Copenhagen, principally from the cave-dwelling Berbers of the south. A French summary appears in the *Tour du Monde* 4 (1898): 481–492.

West Africa. *M. Deutsch. Schutzgebieten* **11** (1898): 177–183. **Besser.**
Bericht über die Expedition zur Festsetzung der deutsch-englischen Grenze zwischen dem Niger Coast Protectorate und der deutschen Kolonie von Kamerun. Von Premierlieutenant v. Besser. *With Map.*

An account of the Anglo-German frontier between Kamerun and the Niger territory, with a map on the scale of 1 : 150,000 of the district between the Rio del Rey and Cross river. On pp. 191–194, Dr. R. Kiepert and Herr M. Moisel give notes on the compilation of this map, and a list of the material they employed.

West Africa. **Freeman.**

Travels and Life in Ashanti and Jaman. By Richard Austin Freeman. London: A. Constable & Co., 1898. Size 10 × 7, pp. xx. and 560. *Maps and Illustrations. Price* 21*s.*

This book describes a journey from the Gold Coast through Ashanti, and a residence in Bontuku before it had been assigned to the French sphere. In addition to the account of the journey with various natural history notes, there are two chapters on the history and present state of Ashanti, one on malaria—the author is a medical map —and one on the commercial outlook. Dr. Freeman has already contributed an important paper on the same subject to the Society. See *Supplementary Papers*, vol. iii.

Western Sudan. *Imp. and Asiatic Quarterly Rev.* 6 (1898): 322–341. **Lobb.**

British Influence in the Western Soudan: its History and Results. By R. Popham Lobb.

NORTH AMERICA.

Bermuda. **Stark.**

Stark's Illustrated Bermuda Guide: containing a description of everything on or about these places of which the Visitor or Resident may desire information, including their History, Inhabitants, Climate, Agriculture, Geology, Government, and Resources. By James H. Stark. Boston: J. H. Stark; London: Low & Co. 1897. Size 8 × 5½, pp. viii. and 154. *Maps, Plan, and Illustrations. Price* 6*s.*

North America—Glaciers. **Russell.**

Glaciers of North America. A Reading Lesson for Students of Geography and Geology. By Israel C. Russell. Boston, U.S.A.: Ginn & Co., 1897. Size 9½ × 6½, pp. x. and 210. *Maps and Illustrations. Price* 6*s.*

An introductory chapter treats of glacial phenomena in general; the glaciers of the Sierra Nevada, of Northern California and the Cascade Mountains, of the Canadian Rockies, of Alaska, and of Greenland are then successively considered, and several concluding chapters deal with the theory of glaciers.

United States. *J. School G.* 2 (1898): 281–291. **Gilbert.**

Origin of the Physical Features of the United States. By G. K. Gilbert. *With Map.*

United States. *National G. Mag.* 9 (1898): 377–386. **McGee.**

The Growth of the United States. By W. J. McGee.

United States—California. *J. Geology* 6 (1898): 551–576. **Fairbanks.**

Geology of a portion of the Southern Coast Ranges. By H. W. Fairbanks. *With Illustrations.*

United States—Colorado. *National G. Mag.* 9 (1898): 431–434. **Newell.**

Mesa Verde. By F. H. Newell.

United States—Maine. **Keating.**

Agriculture of the State of Maine. Foreign Office, Miscellaneous, No. 480, 1898. Size 9½ × 6½, pp. 10. *Price* 1*d.*

United States—Massachusetts. *J. Geology* 6 (1898): 463–472. **Jefferson.**

The Post-glacial Connecticut at Turner's Falls, Mass. By M. S. W. Jefferson. *With Illustrations.*

A history of recent river-evolution.

United States—Meteorology. ——

U.S. Department of Agriculture. Report of the Chief of the Weather Bureau, 1896–97. Washington: Government Printing Office, 1897. Size 12 × 9, pp. x. and 432. *Maps and Diagrams. Presented by the Weather Bureau.*

This report deals in detail with the climatology of the United States, and in particular with the distribution of rainfall over the country and the floods of the Mississippi river.

United States—North Carolina. **Sikes.**

Johns Hopkins University Studies in Historical and Political Science. The Transition of North Carolina from Colony to Commonwealth. By Enoch Walter Sikes, PH.D. Baltimore, 1898. Size 10 × 6½ pp. 84.

United States—Washington. *National G. Mag.* 9 (1898): 417–428. **Gannett.**

Lake Chelan. By Henry Gannett. *With Map and Illustrations.*

Description of a narrow winding lake in the State of Washington, the length being nearly 50 miles, while the breadth averages little over one mile.

United States and Mexico. *National G. Mag.* 9 (1898): 345–371. **McGee.**

Papagueria. By W. J. McGee. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

British Guiana. **Rodway and Stark.**

Stark's Guide-Book and History of British Guiana: containing a description of everything relating to this colony that would be of interest to Tourists and Residents, respecting its History, Inhabitants, Climate, Agriculture, Geology, Gold-mining, Government, and Resources. By James Rodway and James H. Stark. Boston: J. H. Stark; London: Low & Co. [Not dated.] Size 8 × 5½, pp. 120. *Maps and Illustrations. Price 6s.*

Chaco Region. **Brinton.**

The Linguistic Cartography of the Chaco Region. By Daniel G. Brinton, M.D., etc. (Read before the American Philosophical Society, October 8, 1898.) Philadelphia, 1898. Size 9½ × 6, pp. 30. *Map. Presented by the Author.*

A study of the tribes of the Gran Chaco region, including parts of several contiguous countries, with a map showing the distribution of the chief languages, the relations of which are complicated, and have given rise to much difference of opinion.

South America. *J. School G.* **2** (1898): 241–248, 297–311. **Ward**

Climatic Notes made during a voyage around South America. By R. De C. Ward.

South America—Indiarubber. *Deutsche Rundschau G.* **20** (1898): 381–491. ——

Capital und Arbeit in den Kautschukdistricten von Süd-Amerika.

Uruguay. **Grenfell.**

Trade of Uruguay for the year 1897. Foreign Office, Annual No. 2097, 1898. Size 10 × 6½, pp. 14. *Price 1d.*

Venezuela. **Brinton.**

The Dwarf Tribe of the Upper Amazon. By Daniel G. Brinton, M.D. Reprinted from the *American Anthropologist*, September, 1898. Washington, 1898. Size 10 × 6½, pp. [4.] *Presented by the Author.*

Criticizes the belief in a pygmy people existing in the forests of Venezuela.

Venezuela. *Scottish G. Mag.* **14** (1898): 591–599. **Paterson.**

In the Wilds of Venezuela. By Major Stanley Paterson. *With Illustrations.*

A journey up the Cuchivero river.

Venezuela. *Globus* **74** (1898): 163–165, 291–294, 302–307. **Sievers.**

Die Inseln von der Nordküste von Venezuela. Nach den bisherigen Quellen und unter Berücksichtigung des Tagebuches und der Gesteins-Sammlung Richard Ludwigs. Dargestellt von W. Sievers.

West Indies—Barbados. **Franks and Harrison.**

Quarterly J. Geolog. S. **54** (1898): 540–555.

The *Globigerina*-marls [and basal Reef-rocks] of Barbados. By G. F. Franks and Prof. J. B. Harrison. With an Appendix on the Foraminifera, by F. Chapman. *With Sketch-map and Sections.*

West Indies—Curaçoa. **Jesurun.**

Trade of Curaçoa for the year 1897. Foreign Office, Annual No. 2047, 1898. Size 10 × 6, pp. 22. *Price 1½d.*

West Indies—Dominica. **Naftel.**

Report on the Agricultural Capabilities of Dominica. By C. O. Naftel. Colonial Reports, Miscellaneous, No. 9, 1898. Size 10 × 6, pp. 72. *Map. Price 9½d.*

West Indies—Grenada. **Broadway.**

Report on Agriculture in Carriacou. Colonial Reports, Miscellaneous, No. 11, 1898. Size 10 × 6, pp. 18. *Price 1½d.*

West Indies—Jamaica. **Blake.**

Jamaica. Annual Report for 1896–97. Colonial Reports, Annual No. 225, 1898. Size 10 × 6, pp. 52. *Price 3d.*

West Indies—St. Vincent. **Thompson.**

St. Vincent. Annual Report for 1897. Colonial Reports, Annual No. 233, 1898. Size 10 × 6½, pp. 14. *Price 1d.*

West Indies—Trinidad. **Knollys and Low.**

Trinidad and Tobago. Annual Report for 1897. Colonial Reports, Annual No. 241, 1898. Size 10 × 6½, pp. 28. *Price 2d.*

AUSTRALASIA AND PACIFIC ISLANDS.

German New Guinea. Lauterbach, Danckelman, and Cohn.

Z. Ges. Erdk. Berlin 33 (1898): 141–182.

Die geographischen Ergebnisse der Kaiser Wilhelms-Land-Expedition. Von Dr. C. Lauterbach. *With Maps.*

Die Ergebnisse der barometrischen Höhenmessungen und meteorologischen Beobachtungen der Kaiser Wilhelms-Land-Expedition von 1896. Von Dr. von Danckelman.

Astronomische Ortsbestimmungen der Kaiser Wilhelms-Land-Expedition. Berechnet von Dr. Fritz Cohn.

This is noticed in the *Journal* for December, 1898, p. 617.

Hawaii. Kenny.

Trade of the Hawaiian Islands for the year 1897. Foreign Office, Annual No. 2193, 1898. Size 10 × 6½, pp. 12. *Price* 1*d.*

During 1897 the imports to Hawaii came in the following proportions: from the United States, 76·94 per cent.; from the United Kingdom and British possessions, 11·85 per cent.; and the rest (11·21 per cent.) distributed equally between Germany, China, Japan, and other countries. All the exports went to the United States.

New Zealand—Gold Dredging. Jacquet.

New South Wales. Department of Mines and Agriculture. Geological Survey. Mineral Resources. No. 3. Notes on Gold Dredging, with reference to the Introduction of the Industry into New South Wales. By J. B. Jacquet. Sydney, 1898. Size 9½ × 6¼, pp. 22. *Map and Plates. Price* 1*s.* 6*d.*

Queensland. *T.R.G.S. Australasia* (*Victoria*) 15 (1898): 24–32. Le Souëf.

Ascent of Mount Peter Botte, North Queensland. By Dudley Le Souëf. *With Illustration.*

South Australia. Lindsay and Winnecke.

South Australia. Reports on Tablelands, Northern Territory. By D. Lindsay and C. Winnecke. Adelaide, 1898. Size 13¼ × 9, pp. 4. *Presented by the Colonial Office.*

Western Australia. ———

Western Australia. Report of the Department of Mines for the year 1897. Perth, 1898. Size 13¼ × 8¼, pp. 210. *Plan and Diagram. Presented by the Department of Mines, Western Australia.*

A diagram showing the quarterly output of gold for Western Australia brings out in a striking way the fact that, while 1250 ounces were raised in 1887, no less than 225,000 ounces were produced in the last quarter of 1897. The report gives in detail the official data for the output of each goldfield.

Western Australia. Chambers.

A Land of Promise: Western Australia in 1897–98. By Trant Chambers. Second Edition. Perth, 1898. Size 8½ × 5½, pp. 140. *Map and Illustrations.*

Western Australia—Geological Survey. ———

Western Australia. Annual Progress Report of the Geological Survey for the year 1897. Perth, 1898. Size 13 × 8¼, pp. 66. *Maps and Plans. Presented by the Geological Survey of Western Australia.*

This report contains, amongst others, a large-scale geological map of the Coolgardie district.

POLAR REGIONS.

Antarctic Exploration. *Nautical Mag.* 67 (1898): 217–220. ———

Antarctic Exploration. By "Zero."

Arctic Pilot. Penn.

The Arctic Pilot. Volume i. Sailing directions for the Barents, Kara and White seas. Compiled . . . by Commander H. S. Penn, R.N. London: J. D. Potter, 1898. Size 9½ × 6, pp. xxxiv. and 352. *Index Charts. Price* 6*s. Presented by the Hydrographic Office, Admiralty.*

The importance of navigation in the Arctic Sea is shown by the fact that the old 'White Sea Pilot' has been recast and extended to include navigation to the mouth of the Yenesei and the coast of Novaya Zemlya.

Greenland. *Ann. G.* 7 (1898): 441–456. **Zimmermann.**
Le régime glaciaire au Groenland, d'après un ouvrage recent. Par M. Maurice Zimmermann. *With Illustrations.*

A review of Drygalski's great work.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Land and Water. **Beythien.**
Eine neue Bestimmung des Pols der Landhalbkugel. Von Dr. Phil. Hermann Beythien. Kiel und Leipzig: Lipsius & Tischer, 1898. Size 10 × 6½, pp. 30. *Maps. Presented by the Author.*

Land Forms. *J. Geology* 6 (1898): 704–710. **Iddings.**
Bysmaliths. By Joseph P. Iddings.

The author points out that, while an intruded sheet of igneous rock is flat, a laccolith is a mass of igneous rock intruded amongst sedimentary strata so as to elevate them into a dome, and a bysmalith is a more abrupt plug of intruded igneous rock, like, but not to be confounded with, a stock or volcanic neck.

Physical Geography. *National G. Mag.* 9 (1898): 435–447. **McGee.**
The Geospheres. By W. J. McGee.

Mr. McGee recognizes four geospheres—the atmosphere, hydrosphere, lithosphere, and centrosphere. He points out how the interactions between these affect geographical conditions.

Physical Geography. *J.G. Tokyo G.S.* 10 (1898): 215–225. **Yazu.**
On the Definition of Physical Geography. By Masanaga Yazu. [In Japanese.]

Rain and Rivers. *B.A. Imp. Sci. St.-Pétersbourg* 7 (1897): 375–381. **Gravelius.**
Vorläufige Mittheilung über einige Ergebnisse der Anwendung einer Methode des Herrn Rykatschew zum Studium des Zusammenhangs zwischen Niederschlag und Wasserstand. Von Dr. Harry Gravelius.

Seismology. **Milne.**
Seismology. By John Milne, F.R.S. London: Kegan Paul & Co., 1898. Size 7½ × 5½, pp. xvi. and 320. *Illustrations. Price 5s. Presented by the Publishers.*

Seismometry. *Sitzb. k. A.W. Wien* 106, Abth. IIa. (1897): 551–561. **Pfaundler.**
Ueber einen Erdbeben-Registrator mit elektrisch-photographischer Aufzeichnung des Zeitmomentes des Stosses Von L. Pfaundler.

Terrestrial Magnetism. *Terrestrial Magnetism* 3 (1898): 93–134. ———
The International Conference on Terrestrial Magnetism and Atmospheric Electricity. *With Diagrams.*

Terrestrial Magnetism. *P.A. Imp. Sci. St.-Pétersbourg* 8 (1898): 191–205. **Wild.**
Ueber die Einrichtung erdmagnetischer Observatorien. Von H. Wild. *With Plan.*

Tides. **Darwin.**
The Tides and Kindred Phenomena in the Solar System. The substance of lectures delivered in 1897 at the Lowell Institute, Boston, Massachusetts. By George Howard Darwin. London: John Murray, 1898. Size 8 × 5½, pp. 18 and 342. *Illustrations. Price 7s. 7d. Presented by the Publisher.*

Zoogeography. *Science* 8 (1898): 615–618. **Miller.**
An Instance of Local Temperature Control of the Distribution of Mammals. By Gerrit S. Miller, Jr.

This is a case of an "island" of low temperature due to local causes resulting in the establishment of a boreal fauna far to the south of their proper habitat.

BIOGRAPHY.

Reveillère. *Deutsche Rundschau G.* 21 (1898): 84–85. ———
Contreadmiral P. E. M. Reveillère. *With Portrait.*

Schaffter. *XVI. Jahresb. G. Ges. Bern*, 1897 (1898): 59–63. **Ducommun.**
Albert Schaffter et la Société de Géographie de Berne. Par M. Elie Ducommun.

The subject of this biography was born in 1823, founded the Bern Geographical Society in 1873, and died in 1897.

Schefer. **Cordier.**

Charles Schefer, Membre de l'Institut. Par Henri Cordier. Paris, 1898. Size 8½ × 6, pp. xvi. *Presented by the Author.*

Thoroddsen. *Globus* 74 (1898): 161–163. **Lehmann-Filhés.**

Dr. Thorvaldur Thoroddsen. Von M. Lehmann-Filhés. *With Portrait.*

Waghorn. *Imp. and Asiatic Quarterly Rev.* 6 (1898): 386–395. **Waghorn.**

The Pioneer of the short and rapid route to India and the East. By Agnes E. Waghorn.

Wakefield. *Blackwood's Mag.* 164 (1898): 821–828. ———

A Maker of Colonies.

A sketch of the life and work of Edward Gibbon Wakefield (1796–1862), who was a pioneer in colonial enterprise in the first half of the century.

GENERAL.

Educational—Text-book. **Löffler.**

Omrids af Geographien nærmest udarbejdet til brug ved forelæsminger. Af Dr. E. Løffler. 2 vols. (in 1). Kjøbenhavn: Lehmann & Stages, 1893 and 1898. Size 9½ × 6½, pp. (vol. i.) 532; (vol. ii.) 848. *Presented by the Author.*

A Danish treatise on geography, with a short general introduction and more detailed descriptions of each continent; the section on Europe being that more recently published. The method of treatment is based on geological and physical structure, and there are some excellent illustrative sketch-maps.

Geographical Discovery. **Jacobs.**

The Story of Geographical Discovery. How the World became known. By Joseph Jacobs. With Twenty-four Maps, etc. London: G. Newnes, Ltd., 1899 [1898]. Size 6½ × 4, pp. 224. *Price 1s. Presented by the Publishers.*

This little volume contains a compact and carefully arranged summary of the history of discovery, written in a very popular style, and likely to interest the general reader and call attention to an aspect of geography which has been much and undeservedly neglected. A condensed table, "The Annals of Discovery," gives the dates of the more important explorations in all parts of the world. There are references to more advanced histories, and several interesting illustrations.

Oriental Collections. **Cordier.**

La Collection Charles Schefer. Par Henri Cordier. Paris: *Gazette des Beaux-Arts*, 1898. Size 11½ × 8, pp. 20. *Illustrations.*

Pacific Powers. *Nineteenth Century* 44 (1898): 656–672. **Taylor.**

The Coming Struggle in the Pacific. By Benjamin Taylor.

Place Names. *A travers le Monde, Tour du Monde* 4 (1898): 307–308. **Maison.**

Une explication de l'étymologie de Londres. Par Émile Maison.

Place-Names. *T.R.S. Literature* 20 (1898): 37–104. **Phené.**

Place-Names in and around Rome, Latium, Etruria, Britain, etc., with Earth-works and other Works of Art illustrating such Names. By Dr. Phené. *With Illustrations.*

Dr. Phené discusses the similarity of certain ancient serpentine roads and other structures in Italy and Britain, and deduces conclusions as to place-names supported by a wealth of archæological references.

Russian Hydrographic Publications. ———

Catalogue of Atlases, Charts, Plans, Views, Albums of Flags, Navigation Guides, etc. Corrected to March 1, 1898. Published by the Chief of the Hydrographic Department, Ministry of Marine. [In Russian.] St. Petersburg, 1898. Size 9½ × 6½, pp. iv. and 128.

Travellers' Equipment. **Brown.**

The Equipment of Exploring Expeditions. A paper read before the Institution of Mining Engineers. By M. Walton Brown. General Meeting at London, May 20, 1898. Excerpt from the *Transactions of the Institution of Mining Engineers.* London and Newcastle-upon-Tyne: A. Reid & Co., 1898. Size 10 × 6½, pp. 12. *Presented by the Secretary of the Institution.*

A practical man's advice as to the most convenient appliances for use on exploring expeditions.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

ARCTIC REGIONS.

Spitsbergen. **Kjellström and Hamberg.**

Karta öfver Kung Karls Land upprättad under 1898 års svenska polarexpedition af C. J. O. Kjellström och A. Hamberg. Scale 1 : 200,000 or 2·9 stat. mile to an inch. *Presented by Dr. Nathorst.*

This is a reduction of the survey, made during last summer, by Lieut. C. J. O. Kjellström and Dr. A. Hamburg, who accompanied Dr. A. G. Nathorst's Swedish arctic expedition.

EUROPE.

England and Wales. **Ordnance Survey.**

Publications issued since December 8, 1898.

1-inch—General Maps:—

England and Wales:—83, 200, hills engraved in black or brown; 70, 104, 116, 132, 144, 160, 174, 175, 183, 189, 190, 191, 198, 265, 296 (revision) engraved in outline; 250, 253, 276, 279, 292, 305, 306, 349, 351 (revision), hills engraved in black or brown. 1*s. each.*

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Austria-Hungary. **Artaria.**

Artaria's Eisenbahn- und Post-Communications-Karte von Oesterreich-Ungarn, 1899. Scale 1 : 1,700,000 or 18·8 stat. miles to an inch. Mit Stationsverzeichnis. Verlag von Artaria & Co., Wien. *Price* 1 *fl.*

England. **Bartholomew.**

Plan of Manchester and Salford. Scale 300 yards to an inch. By J. Bartholomew, F.R.G.S. London: W. H. Smith & Sons, 1898. *Presented by Messrs. J. Bartholomew & Co. Price* 2*s.*

Europe. **International Geological Congress.**

Carte géologique internationale de l'Europe. 49 feuilles à l'echelle de 1 : 1,500,000 or 23·6 stat. miles to an inch. Livraison III., contenant les feuilles A. III., A. IV., B. III., B. IV., C. V., D. V., D. VI. La Carte, votée au Congrés géologique international de Bologne en 1881, est exécutée conformément aux décisions d'une Commission internationales avec le concours des Gouvernements, sous la direction de MM. Beyrich et Hauchecorne. Berlin: Dietrich Reimer, 1898. *Presented by the Royal Society.*

This is Part III. of the geological map of Europe, which is in course of publication in conformity with a resolution passed by the International Geological Congress of 1881. The maps of the present issue contain the British Isles and the north coast of France, the Alps and Northern Italy, Austria-Hungary, the Balkan Peninsula, and the southern extremity of Italy. This important map will be completed in forty-nine sheets, of which eighteen are now published.

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abtheilung der Konigl. Preuss. Landes-Aufnahme, 1898. Sheets: 281, Bentheim; 298, Meseritz; 327, Cleve; 357, Paderborn. Scale 1 : 100,000 or 1·7 stat. mile to an inch. *Price* 1.50 *marks each sheet.*

Historical Atlas. **Poole.**

Historical Atlas of Modern Europe, from the Decline of the Roman Empire; comprising also maps of parts of Asia and of the New World, connected with European History. Edited by Reginald Lane Poole, M.A., PH.D., Fellow of Magdalen College, and Lecturer in Diplomatic in the University of Oxford. Part XXI. Oxford: The Clarendon Press; London, Edinburgh, Glasgow, and New York: Henry Frowde, M.A.; Edinburgh: W. & A. K. Johnston. 1898. *Price* 3*s.* 6*d. each part. Presented by the Clarendon Press.*

This part contains—Map 52, The Netherlands, by Dr. Julius Frederichs; map 74, South-Eastern Europe and Asia Minor, c. 1210, by Prof. J. B. Bury, M.A., LITT. D.; map 86, European Colonies and Dependencies after the Peace of Utrecht (1713), by Hugh E. Egerton, M.A. Each of these maps is accompanied by explanatory letterpress.

Russia. **Antropoff.**

Financial and Statistical Atlas of Russia. E. A. Antropoff, St. Petersburg, 1898. *Price* 13*s.* 6*d.*

This is a financial and statistical atlas of European Russia, containing numerous maps and diagrams illustrating the different subjects dealt with. The letterpress is in Russian.

ASIA.

Asia Minor. **Friedrich.**

(1) Handels- und Produktenkarte von Kleinasian, bearbeitet von Dr. Ernst Friedrich. Scale 1 : 2,500,000 or 39·7 stat. miles to an inch. (2) Uebersichtskarte von Kleinasian, bearbeitet von Dr. Ernst Friedrich. Scale 1: 2,500,000 or 39·7 stat. miles to an inch. Halle a. S. Verlag von. G. Sternkopf, 1898. *Presented by the Publisher.*

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch, Sheets: 89, parts of districts Mirzapur and Jubbulpur, Rewah (Native State), Sirgujah, Korea, etc. (Gahrját States), of Chota Nagpur Division, Meyhar, etc. (Native States), of Bundelkhand and districts Banda and Allahabad, additions to 1898; 106, part of district Sambalpur and Garhját States, of Raigarh, Sonpur, Barakhol, and Bamra (Central Provinces), and Band, Athmallik, and Angul (Orissa Tributary States), additions to 1893. Quarter Sheets:

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Malay Peninsula. **Straits Branch of the Royal Asiatic Society.**

Map of the Malay Peninsula. Scale 1: 506,880 or 8 stat. miles to an inch. Straits Branch of the Royal Asiatic Society, 1898. E. Stanford, London. 6 sheets. *Price* 12*s*.

This map supersedes those of the Malay Peninsula which have previously been published for the Straits Branch of the Royal Asiatic Society. In its compilation all the most recent and reliable material has been used, and the boundaries between the different states and territories are distinguished, those defined by survey being shown in a different manner from those which are undefined. All means of communication are laid down, and the localities where minerals are found are indicated. At the foot of the map there is a synopsis of native towns which will be useful.

AFRICA.

Africa. **Bartholomew.**

Bartholomew's Political Map of Africa. Scale 1: 12,000,000 or 189 stat. miles to an inch. J. Bartholomew & Co., Edinburgh, 1899. *Price 3s., mounted on cloth. Presented by the Publishers.*

This is a new edition of this well-known and useful map.

Central and South Africa. **Bartholomew.**

Central and South Africa. By J. G. Bartholomew, F.R.G.S. Scale 1: 5,600,000 or 88 stat. miles to an inch. J. Bartholomew & Co., Edinburgh, 1899. *Price* 3*s*., *mounted on cloth. Presented by the Publishers.*

The present edition of this map has been brought up to date. It contains a considerable amount of detail, and is drawn on a sufficiently large scale to be very useful for the purpose of general reference.

Witwatersrand Goldfields. **Wood and Ortlepp.**

Map of the Witwatersrand Goldfields. Scale 2500 feet to an inch. J. Wood & A. Ortlepp. Published by the Universal Publishing Co., Ltd., London, 1898. *Presented by the Universal Publishing Co., Ltd.*

Persons interested in the Witwatersrand gold-mining industry will find this a useful map for reference. It is drawn on the scale of about half a mile to an inch, and is compiled from official surveys.

GENERAL.

World. **Johnston.**

The World-Wide Atlas of Modern Geography, Political and Physical. Containing 128 plates and complete index. With an introduction by J. Scott Keltie, LL.D., etc. Fourth edition. W. & A. K. Johnston, Edinburgh and London, 1898. *Presented by the Publishers. Price 7s. 6d.*

World. **Andree.**

Andrees allgemeiner Handatlas, 126 Haupt- und 139 Nebenkarten auf 186 Kartenseiten, nebst alphabetischem Namenverzeichnis. Vierte, völlig neubearbeitete, stark vermehrte Auflage, herausgegeben von A. Scobel.—Lief 43, Grossbritannien und Irland.—Lief 44, Balkanhalbinsel.—Lief 45, Nordöstliche Vereinigte Staaten und Südöstliches Canada.—Lief 46, Südafrika. Bielefeld und Leipzig: Verlag von Velhagen and Klasing, 1898. *Price 50 pf. each part.*

World. **Frobenius.**

Versuch einer Darstellung der malajo-nigritischen Kultur und ihrer Verwandtschaft, nach ethnologischen Studien von L. Frobenius. *Petermanns Geogr. Mitteilungen*, Jahrgang 1898, Tafel 20. Gotha: Justus Perthes. *Presented by the Publisher.*

World. **Debes.**

E. Debes' neuer Handatlas über alle Teile der Erde in 61 Haupt- und 124 Nebenkarten, mit alphabetischem Namenverzeichnis. Herausgegeben von E. Debes. Zweite vermehrte und verbesserte Auflage. Leipzig: H. Wagner & E. Debes, 1899.

The principal alterations and additions to this atlas are a new physical map of Europe, showing the elevations of the land and depths of the sea, and a map of the Mediterranean sea and the surrounding countries, on which all steamer routes, railways, and telegraphs are laid down, with three insets illustrating meteorology and botany of the Mediterranean basin. The maps which appeared in the former edition have been corrected and brought up to date, and the indices which formerly followed each map have been superseded by a general index at the end of the atlas.

World. **Bartholomew.**

Atlas for South African Schools. A new series of physical and political maps. By J. G. Bartholomew, F.R.G.S. T. Nelson & Sons, London, Edinburgh, and New York. *Price 1s. Presented by the Superintendent-General of Education for the Cape Colony.*

The preparation of this atlas was undertaken at the suggestion of the Superintendent-General of Education for the Cape Colony. In addition to the usual general maps to be found in this class of atlas, there are corresponding physical and political maps of continents, and a new map of South Africa in six sections. The physical, relief, and vegetation maps of South Africa are also new.

CHARTS.

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic and North Pacific Oceans for January, 1899, and North Atlantic Ocean for December, 1898. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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Geographical Journal.

No. 3. MARCH, 1899. Vol. XIII.

THE PLAN OF THE EARTH AND ITS CAUSES.*

By J. W. GREGORY, D.Sc.

The Variations of Topographic Form.

Despite the extreme variability in the shapes of the continents and their apparently capricious distribution, geographers of all ages have believed that the arrangement of land and water on the globe is based on a regular plan. The plan can, of course, only be recognized in broad outline, for the shape of the land-masses depends on the structure of the Earth-forms, which vary indefinitely. Intricate mountain valley systems open out to wide-flung rolling prairie, stoneless alluvial flats are broken by the crags of rock ridges, volcanic cones stand isolated like pyramids while mountain chains run thousands of miles unbroken. Such contrasts are natural, as the land-forms are the result of the struggle of complex forces with varying powers of attack against complex rock-masses formed of materials having varying powers of resistance. Coast-lines, for example, project where hard rocks repel the surf, where rivers deposit alluvium more quickly than the tide can remove it, or where the winds build up sand-dunes, whose very weakness disarms the waves. Coast-lines are indented where soft beds crumble under frost and rain, and where dominant winds, the inset of an ocean current, or an undulation on the sea floor directs a jet-like stream of water against the shore. Topographical form depends on so many incalculable, inconstant factors that the stages of its growth are often now untraceable. The missing links of geographical evolution are indeed as numerous as those of organic evolution, and the chapter of accidents is invoked by geographers to explain difficulties analogous to those for which naturalists appealed to the doctrine of special creation. But unexplained differences in the geographical units no more disprove an orderly progress in the growth of the continents than the existence of isolated, unexplained groups of animals is fatal to Darwinism. Such topographical differences are of secondary importance in contrast to the numerous coincidences and repetitions of the same essential form among the geographical units. Geographers accordingly have believed that there is a hidden continental symmetry which, when discovered, will explain the law that has determined the distribution of land and water on the globe.

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* Read at the Royal Geographical Society, January 23, 1899. Diagram, p. 336.

This idea dates from the dawn of geographical science. The early classical geographers noticed how the seas radiated from the Levantine area, and opened to a broad boundless ocean. They accordingly described the land of the globe as an island, floating on a vast surrounding sea, whence channels converged towards the hub of the classical universe. This radial plan reappears in the mediæval wheel-maps, in which Jerusalem was accepted as the centre of the world, whence the main geographical lines radiated like the spokes of a wheel.

These systems fell for ever on the discovery of America, which could not be brought into conformity with the radial plan by even the ingenious devices of mediæval cartographers. Later on came an even worse blow. Geologists showed that, instead of the land areas being fixed and immutable, they are really more fickle and less enduring than the sea. The distribution of land is therefore constantly changing, owing to local variations in its level. The discovery of this truth seemed to destroy the very basis of any possible Earth-plan. Indeed, Lyellism, with its essential doctrine of the alternate elevation and subsidence of the land under the agency of local causes, seemed inconsistent with the existence of any general cause governing the geographical evolution of the globe as a whole.

But a truer appreciation of this later knowledge did not confirm these first deductions. America is now used as the typical or, to borrow a biological phrase, the schematic continent. And when, remembering the probability of local variations in land-level, allowance is made for them, new resemblances are revealed, and exceptions that once were serious difficulties are removed. For instance, the oceans all end in triangles pointing to the north. This is the case with the Pacific, the two sections of the Indian ocean, and the basins of the Mediterranean. The Atlantic alone is broadly open at its northern end. But Scotland and Iceland are connected by a submerged ridge, which is said to be capped by a line of old moraine. If this ridge were raised to sea-level, the Atlantic would conform to the general rule by tapering northward to a point between Iceland and Greenland.

Similarly with the land-masses. There seems at first sight no resemblance in shape between the Old World and the New. But the Old World is divided into halves by a band of lowland, which extends southward from the Arctic ocean to the Caspian, and northward from the Arabian sea up the Persian gulf. There is evidence to show that the sea recently covered these northern lowlands and occupied the Persian depression; while somewhat earlier, in Miocene times, the intervening ridge was also submerged. Restore these conditions, and the continents would occur as three meridional belts, each broken across by transverse Mediterranean seas, viz. North and South America separated by the Caribbean depression; Europe and Africa (the Eurafrica of Prof. Lapworth) separated by the Mediterranean; Asia and Australasia divided by the Malaysian folds.

Hence the oscillating character of the land, which appeared fatal to the old faith in an Earth-plan, helps to justify it, now that oceanography and geology have shown us how much to allow for the obscuring action of these changes of level.

But it is inadvisable, in attempting to explain the existing plan of the Earth, to introduce any alterations in the distribution of land and water. For, although a geologist may have no doubt about such assumed changes, he cannot expect geographers to have an equal faith in them, or even to take much interest in a world thus modified. The geographer is concerned with the existing arrangement of the world, and not with the more or less problematical plans of former ages. The introduction of earlier and more primitive geographical systems, though it would simplify the question, is unnecessary, since the existence of a present Earth-plan is clearly revealed by three striking facts.

Geographical Symmetry.

Two of these facts are stated in every geographical text-book. They are evident on the most casual examination of a map. The first is the concentration of land in the northern, and of sea in the southern hemisphere. The second is the triangular shape of the geographical units. The continents are triangular, with the bases to the north. The oceans are triangular, with the bases to the south. Accordingly the land forms an almost complete ring round the north pole, and from this land-ring three continents project southwards. The oceans form a continuous ring round the south pole, and from it three oceans project northward into the angles between the continents. The belts of sea and land are fixed on the Earth's axis like a pair of cog-wheels with interlocking teeth. These two belts may be referred to as the northern land-belt and southern oceanic belt.

The third striking feature in the Earth's physiognomy is less conspicuous, but is even more significant. It is known as the antipodal arrangement of oceans and continents. It is most easily recognized by examination of a globe; but it can easily be illustrated by a plain map. The antipodes of a point in the centre of the continent of North America occurs in the Indian ocean; and if we mark on a map the antipodes of all the points in North America, we should find that the whole of that continent is exactly antipodal to the Indian ocean. Similarly, the elliptical mass of Europe and Africa is antipodal to the central area of the Pacific ocean; the comparatively small continent Australia is antipodal to the comparatively small basin of the North Atlantic; the South Atlantic corresponds — though less exactly—to the eastern half of Asia; and the Arctic ocean is precisely antipodal to the antarctic land.

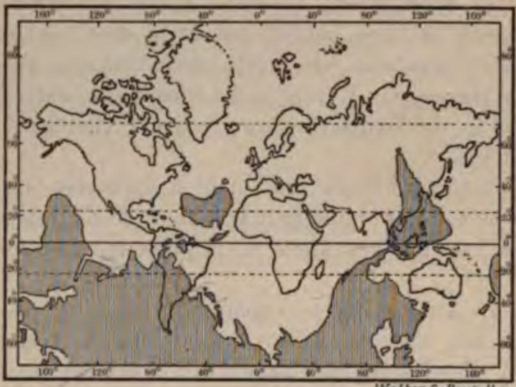
Walker & Boutall sc.

FIG. 1.—MAP OF THE WORLD, SHOWING THE DISTRIBUTION OF ANTIPODAL AREAS.

These, then, are the three fundamental facts in the existing plan of the globe. Our main problem is, Why are the geographical elements thus shaped and thus distributed?

THE EARTH'S CONCENTRIC SHELLS.

It simplifies the statement of the problem to remember that the Earth consists of three parts: there is the vast unknown interior, or "centrosphere," concerning which physicists have not come to any unanimous decision, some saying that it is throughout solid and rigid, others that it is partly fluid, and others again that it is partly gaseous. This interior mass is enclosed by a shell formed of two layers, the solid crust, or "lithosphere," and the oceanic layer, or "hydrosphere." It is possible that at first the two layers of the shell were regular and uniform, in which case the whole world was covered by a universal ocean; but before the dawn of geological history, this arrangement had been disturbed by the formation of irregularities in the surface of the lithosphere. Dry land appeared at the areas of elevation, and the waters gathered together into the intervening depressions.

The problem, then, of the distribution of land and water on the globe is the problem of the distribution of irregularities in the surface of the lithosphere. We are accordingly at once brought face to face with the question, When were the existing irregularities made? If, as many authorities say, these depressions date from the earliest days of the Earth's history, and have lasted unchanged in position throughout geological time, then we are thrown back upon some cause which acted when the Earth was in its infancy. In that case the question is astronomical and physical, instead of geological and geographical.

Pre-Geological Geography.

There have been several attempts to solve the question astronomically, of which the most important is that of Prof. G. H. Darwin. According to his luminous theory, the tidal action of the Sun on the viscous Earth formed two protuberances at opposite points of the equator; one of the protuberances broke away and solidified as the Moon, which revolved round the Earth much nearer than at present. As a new equatorial protuberance formed the Moon pulled it backward, thus causing a series of wrinkles in the Earth's crust, which persist as the main structural lines of the continents. These wrinkles ran at first north and south from the equator. But, owing to the Moon's strong pull on the equatorial girdle, this part of the Earth would tend to revolve more slowly than the polar regions. Hence the primitive wrinkles were deformed; instead of being meridional in direction, they would trend north-easterly in the northern hemisphere, and south-easterly in the southern hemisphere. Prof. Darwin points out that some of the most striking geographical lines on the Earth run in accordance with this plan. He instances the eastern coast of North America, the western coast of Europe, part of the coast of China, and the southern part of South America. But, with characteristically Darwinian frankness, he does not overpress the facts, admits that the resemblances are not so convincing as they might be, and that some cases, *e.g.* the western coast of North America, are absolutely inconsistent with the scheme.

Another theory that attributes the formation of the main geographical lines to pre-geological incidents is given in a paper by Prinz, "Sur les similitudes que presentent les cartes terrestes et Planétaires," which elaborates and gives an astronomical basis to ideas previously suggested by Lowthian Green and Daubrée. His theory is that the northern part of the Earth had a lower angular velocity than the equatorial and southern regions. Therefore the land masses in the southern hemisphere were gradually pushed forward towards the east. The line between the northern retarded hemisphere and the southern swifter hemisphere is the great line of weakness and fracture that runs from the Caribbean along the Mediterranean, down the Persian gulf and across Malaysia. Prinz has drawn a map (Fig. 2) showing how the main geographical lines agree with his assumed lines of torsion.

This map is interesting, for these primitive torsion wrinkles must have been formed in the same period as Prof. Darwin's primitive tidal wrinkles. It is significant that the lines do not correspond. The chief geographical lines which Darwin claims as his primitive wrinkles are inexplicable on Prinz's theory, and the great lines which Prinz claims to support his wrinkling are opposed to those of Darwin. The geographical primitive lines of the two theories are often contradictory.

A third theory assigning the geographical distribution to very ancient causes has been proposed by Prof. Lapworth. In an address to the geographical section of the British Association in 1892, and in a brilliant lecture on "The Face of the Earth," delivered to the Royal Geographical Society in 1894, Lapworth attributed the arrangement of oceans and continents to an intercrossing series of primitive earth-folds. The oceans, according to this theory, occupy ancient basins of depression; and the continental masses are domes of elevation.

"The surface of the Earth-crust at the present day," says Lapworth, "is most simply regarded as the surface of a continuous sheet which has been warped up by two sets of undulations crossing each other at right angles. . . . The one set ranges parallel with the equator, and the other ranges from pole to pole." Prof. Lapworth contends that the intersecting of two simultaneous orthogonal sets of undulations explains the forms and dispositions of the continents, the triangular shapes of their extremities, the diagonal trends of their shores, and the course of the linear archipelagoes. In some interesting diagrams he suggests why the intersecting nodal lines which mark the divisions between the areas of elevation and of depression should coincide with the steep slopes that separate the ocean floors and the continental platforms; and why the existing shore-lines should so often run diagonally between the meridions and parallels.

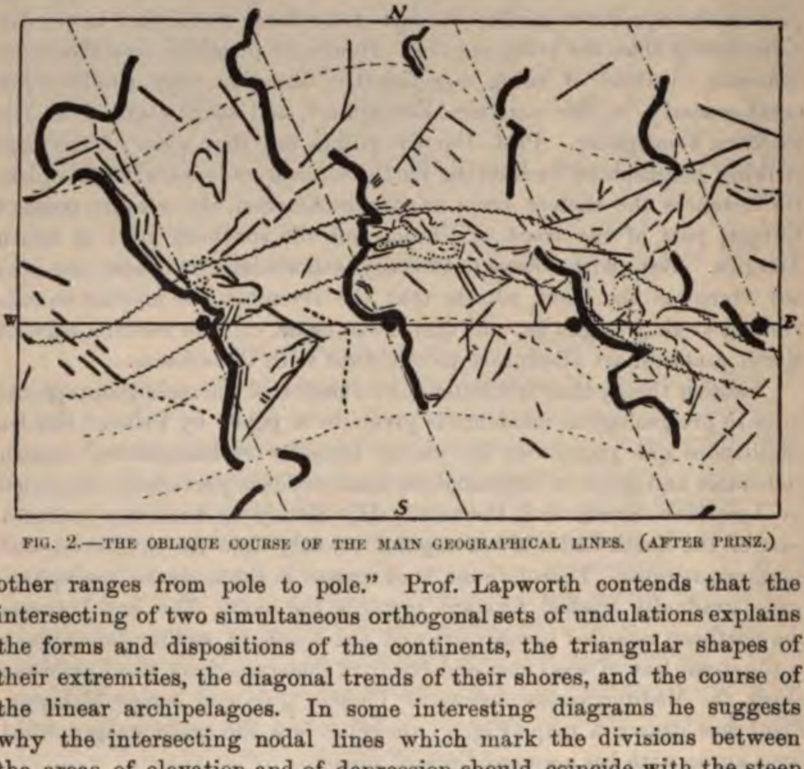

FIG. 2.—THE OBLIQUE COURSE OF THE MAIN GEOGRAPHICAL LINES. (AFTER PRINZ.)

This theory, and that of Sir John Lubbock, which also attributes the continental forms to a double intercrossing series of folds, have the advantage over the astronomical theories of more detailed agreement with geographical facts; but Prof. Lapworth has not, so far as I am aware, explained what caused his intersecting folds. His theory is accordingly less complete than the others, as it is rather a statement of facts than an explanation of causes.

These suggestive theories are open to one objection which seems fatal to their application to the existing geographical plan. We should expect from them that the main geographical structure lines in the northern and southern hemispheres should be either symmetrically arranged or continuous on both sides of the equator. But that the land systems of the two hemispheres are asymmetrical is the most glaring fact in geography. It may be urged that the primitive folding, wrinkling and torsion formed a symmetrical or continuous land system, and that the asymmetrical arrangement is due to later movements. In that case the theories are geographically inadequate, because they give no explanation of how the existing geographical asymmetry was developed.

But there is another and still more serious objection which applies to all three theories. They not only explain too little, but they explain too much. The primitive lines of these systems often coincide with features of modern development, and are inconsistent with the old-established geographical arrangements. For instance, Prof. Darwin quotes the trend of the western coast of Europe from Spain to Norway as in accordance with his scheme. Prinz makes the primitive line here run exactly at right angles to Darwin's line; and geological evidence favours Prinz. The coast-line from Spain to Norway is almost certainly of modern date, while the lines of wrinkling, both Hercynian and Alpine, run transversely to the direction which they ought to have followed if due to tidal strain. Moreover, Prof. Darwin quotes the western coast of North America as inconsistent with his theory; but that coast is parallel to a line of primitive wrinkling, for there is an archean protaxis to the coast ranges and Rocky mountains.

Prinz's torsion wrinkles are no better. The most striking case of apparent agreement between his theory and geography is the trend of the Andes and Rocky mountains. Prof. Lapworth also lays stress on "the great Rocky Mountain-Andes fold . . . the longest and most continuous crust-fold of the present day."* The agreement was important so long as the Rocky mountains and the Andes were regarded as a single mountain system, connected into a continuous line by a mountain axis running north and south across Central America. But that axial mountain chain in Central America is a myth. Central America is traversed by a series of ridges which run east and west, and not north and south.† The watershed, it is true, runs along the Pacific border, but that is due to a movement later than the mountain ridges which are thus truncated. The continuation of the Andes is in the mountains of Venezuela, not in North America or the Sierra Nevada. The Andes and the mountain system of the western states of America are essentially distinct; they differ in every important respect, geological structure, geographical characters, and dates of formation. Any theory which assigns the Andes and the great mountain series on the western coast of North America to a common origin is thereby prejudiced, instead of being supported.

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* The term "Rocky mountains" is here apparently used for the Sierra Nevada and Coast Range series of British Columbia. The true Rocky mountains are at a great distance (ranging up to 1000 miles) from the Pacific coast, the trend of which they do not determine.

† *E.g.* the Sierra Candela, Cordillera de Dota, Sierra Chiriqui, Sierra Veragua, Cordillera de San Blas, etc.

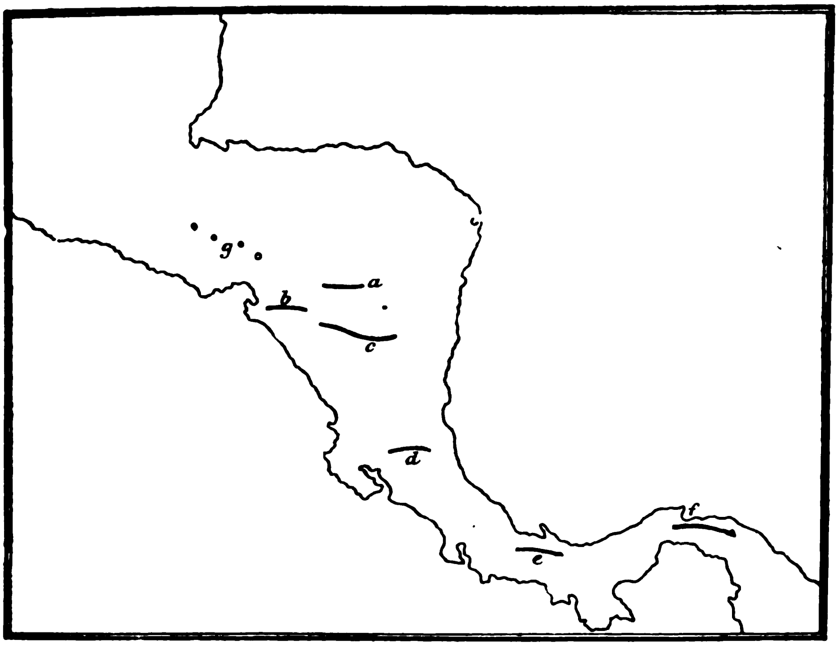

FIG. 3.—THE MOUNTAIN SYSTEM OF CENTRAL AMERICA. *a*, VOLCANIC CHAIN OF HEREDIA; *b*, SIERRA CANDELLA; *c*, CORDILLERA DE DOTA; *d*, SIERRA CHIRIQUI; *e*, SIERRA VERAGUA; *f*, CORDILLERA DE SAN BLAS; *g*, VOLCANIC CHAIN OF ALAJUELA.

These three theories assign the Earth-plan to a venerable antiquity; but there is a fourth theory, which carries it back to an antiquity even more venerable. Lord Kelvin attributes the oceanic and continental areas to a chemical segregation in the gaseous nebula which was the parent of the Earth. According to this theory, "Europe, Asia, Africa, America, Australia, Greenland and the antarctic continent, and the Pacific, Atlantic, Indian, and Arctic ocean depths, as we know them at present," were all marked out in the primæval gaseous nebula. These gaseous continents condensed to liquid continents, marked off from the sub-oceanic areas by chemical differences; and these liquid continents were fixed as the solid continents, heightened by shoaling as the molten globe and its last lava ocean solidified.

That theory appears probable with one verbal amendment—the substitution of the term "archean-blocks" for continents. That these archean blocks—the Earth's great corner stones—were embryonically outlined by chemical segregations in the molten or gaseous stages of the Earth seems probable. But these archean corner stones, though the foundations of the continents, are not the continents. Lord Kelvin's theory suggests no explanation why chemical segregations should have assumed the shapes of the continents, so that his explanation rests on an unexplained cause; and even if his theory be amended by application to the archean blocks instead of to the continents, the theory is geographically insufficient, as it does not show the relation between the archean blocks and the existing continents.

THE PERMANENCE OF CONTINENTS.

That Lord Kelvin's nebulous segregations, Prof. Darwin's primitive wrinkling, Sir John Lubbock and Prof. Lapworth's double folds are all true causes seems probable. What is doubtful is whether any extensive trace of their influence can be discerned in the present distribution of land and water. A map of the world in early Cambrian times might show the influence of these pre-geological incidents; but their geographical effects seem to have been obliterated by the changes of geological times.

Reference to such changes reminds us that we cannot assume their occurrence without considering the unending controversy as to the supposed permanence of oceans and continents.

There are, it must be conceded, many weighty arguments in favour of the permanence hypothesis. Many of the last great mountain foldings follow the lines of much older movements; and if the mountain axes, the "backbones of the continents," have occupied the same positions, why not also the continents moulded upon them? Again, some of the great mountain chains, such as the Andes, run parallel to the nearest shore-line, as if the movements that formed them had been deflected by the ocean basin.

The character of the ocean floors, moreover, suggests that they have never been continental, as they are at present covered by deposits not known in the interior of the continents; and as they are supported by material much heavier than that which forms the foundations of the continents.

These arguments, however, are not conclusive. Great earth movements of one date often cut obliquely and transversely across those of earlier periods. Thus the old north-westerly and south-easterly movements of France and Spain have been cut across by the east and western movements of the Pyrenean-Alpine system. Mountain axes have not always been deflected by or limited by existing ocean basins. Thus the north Atlantic basin cuts directly across the old Hercynian mountain chains, which may at one time have extended across the whole Atlantic channel. This is rendered probable by three lines of evidence. Thus in north-western France, and in the south of the British Isles, there is a series of ranges trending north of west, which is cut off abruptly by the Atlantic slope. On the opposite shore of the Atlantic in Newfoundland, there is a similar series of truncated ranges formed at the same age as those of western Europe, and having the same trend. Bertrand maintains (1887) that the resemblance between the opposite mountain series is so striking that they should be regarded as parts of one mountain system, of which the central part has been sunk below the Atlantic. The well-known telegraph plateau on which the cables rest may mark the site of this sunken land. Palæontological evidence also supports the formation of the Atlantic by subsidence; for a shallow water, sub-tropical, marine fauna ranged from the Mediterranean to the Caribbean, and can only have crossed along a belt of shallow water in tropical or sub-tropical latitudes. Direct evidence of the existence of shallow water, continental deposits of the age required is given by the Azores, which, although now separated from Europe by a deep depression, contain shallow water deposits with fossils of the Mediterranean fauna.

Thus there is strong evidence to show that the Atlantic, in its present form, is of no great geological antiquity, and Suess' theory of its origin continually gains stronger support. Similar, though less complete, evidence shows that the other ocean basins have been broken up along certain lines, and emphatically denies their entire permanence throughout geological times.

ÉLIE DE BEAUMONT'S "PENTAGONAL RESEAU."

Hence, if the ocean basins were not formed pre-geologically, but have grown from the changes that have occurred during the long ages of geological time, then we must seek for a cause that has acted continuously, and is acting to-day. A more permanent cause is supplied by the contraction of the Earth's crust, as the globe gradually cools. Since the cold, hard crust is less plastic than the hotter interior, it is necessarily crumpled as it is forced into a smaller space.

This idea is well known, as it has been invoked by geologists to explain the formation of folded mountain chains. That the mountain systems of the world were formed by this agency is improbable; but it is perhaps still too much to say that it is impossible. For Prof. G. H. Darwin has suggested that the contractility of the rocky crust has been exaggerated, and it has been shown that Reade's level of no strain may lie much deeper than was at first thought.

That secular contraction is the direct cause of the great fold-mountain systems is however less widely believed by geologists than it once was; but it may have an important influence in determining their direction. The trend of the great chains of fold-mountains is to us a significant question, because there is much truth in the phrase, proverbial since its use in 1682 by Burnet, in his 'Theory of the Earth,' which describes the mountain chains as the "backbones of the continents." The first geological attempt to explain the plan of the Earth was based on this belief. The author of this system was the French geologist Élie de Beaumont, whose theory of geomorphogeny was stated at length in his 'Notice sur les systèmes de montagnes' (3 vols.: Paris, 1852). This famous theory was based on a correlation of the mountain chains by means of their orientation. Élie de Beaumont accepts the view that the Earth consists of a thin rigid crust surrounding a fluid, solidifying interior. The crust being thin, it necessarily collapses as the internal mass contracts. He assumes that these collapses occur at intervals of time, and that at these collapses the crust is broken along lines of weakness, which are crumpled up into mountain chains. He assumes that for practical purposes the Earth's crust may be taken as homogeneous; hence that the fractures of the crust would be regularly distributed, and those of successive periods would cross one another along the lines of a regular symmetrical network.

Among the regular simple geometrical forms, that known as the pentagonal dodecahedron, which is enclosed by twelve equal regular pentagons, possesses an exceptionable degree of bilateral symmetry, *i.e.* it can be cut into exactly similar halves in an unusually large number of directions. Sections along any of the edges of any of the pentagons and through the centre of the pentagonal dodecahedron divide it into equal and similar halves. So also do sections from the centre of the pentagons to any of the angles, and likewise sections across the pentagons from alternate angles. Each face of a pentagonal dodecahedron may therefore be divided by fifteen planes of symmetry.

A sphere may be described upon the pentagonal dodecahedron, so that all the corners (or, to use the correct term, solid angles) occur in the surface of the sphere. By joining the corners by lines, the sphere is marked off into twelve spherical pentagons, which possess the same amount of symmetry as the plane pentagons. The lines where these planes of symmetry cut the surface of the sphere form a network of spherical triangles. Such a network Élie de Beaumont called his pentagonal network, and he used it in the following way. He studied the mountain ranges of the world, and by elaborate calculations showed their relative directions at a few localities which he chose as centres of comparison. He found that many mountain ranges have the same orientation, and that others cross the first set at definite regular angles. The directions of the different sets of mountain ranges coincide with the lines of his pentagonal network. Élie de Beaumont claimed that the mountains whose directions are parallel,* were formed at the same date. Successive mountain-forming movements raised chains parallel to different edges of the network; and thus the intersecting mountain lines of the world, and, consequently, the forms of the continents, were determined.

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* For explanation and justification of this use of the word "parallel," see Hopkins, "Presid. Address, Geol. Soc.," *Quart. Jour. Geol. Soc.*, vol. ix. p. xxix.

Élie de Beaumont had no difficulty in pointing out striking coincidences between important geographical lines and his pentagonal network. Thus the Mediterranean volcanic axis, passing through the Grecian archipelago, Etna, and Teneriffe, is parallel to the Alpine chain, and at right angles to the circle through Etna, Vesuvius, Iceland, and the Sandwich Isles. He was able to show a close geometrical relationship between those lines and the line of the Andes, with the pentagon that covers Europe. That the Earth is traversed by great intersecting lines is undeniable. *E.g.* Daubrée showed that the valley system of Northern France follows a line of rectangular fractures, which he called diaclases. The directions of the Greenland fiords is determined by a similar series of intersecting diaclastic fractures. Bertrand has shown that the movements in the Paris basin, the North sea, and English channel, have followed a double set of orthogonal intersecting lines.

But that the fracture lines or lines of weakness in the Earth's crust should intersect more or less rectangularly is natural on any theory of their formation. And such coincidences as those pointed out by Élie de Beaumont in support of his system are inevitable in so crumpled a globe as ours; but they are not sufficiently numerous to be convincing, especially in face of the fundamental differences between the facts of geography and Élie de Beaumont's elaborate artificial system. His theory could only be applied to a symmetrical world; * in a dodecahedron the opposite faces are always similar and parallel; in Élie de Beaumont's network the antipodal areas are always similar. But, as we have seen, the fundamental fact in the plan of the world is that opposite areas are dissimilar. In crystallographic language, the lithosphere is hemihedral, not holohedral; and no scheme based on a holohedral form will serve. It is the recognition of this principle that led to the next great advance.

THE TETRAHEDRAL THEORY.

Élie de Beaumont's scheme is now mainly of historic interest, though Lefort's recent map of the Nivernais shows that it is still used as a working hypothesis by some French geologists. But Élie de Beaumont's theory marked an epoch in this subject, for it led to the system of Mr. Lowthian Green, which far better meets the requirements of the case.

This system was founded in 1875, by Mr. Lowthian Green, in a work which was neglected or ridiculed at the time of its appearance. Like his predecessor, Green assumes that the Earth is a spheroid based on a regular geometrical figure. He adopted as his base the apparently hopelessly unsuitable figure of the tetrahedron, which is contained within four equal similar triangles. This form, with its four faces, six sharp edges and four solid corners, does not conform to the ordinary conception of the figure of the globe. Any comparison between them looks ridiculous. But if we place a three-sided pyramid on each face of the tetrahedron, its proportions are nearer those of a globe; and if these pyramids had elastic sides, so that they could be blown out and the faces thus made curved, then the tetrahedron would become spheroidal and even spherical. Conversely, if a hollow sphere be gradually exhausted of air, the external pressure may force in the shell at four mutually equidistant points, and, by the flattening of these four faces, make it tend towards a tetrahedral form. Now the tetrahedral theory does not regard the world as a regular tetrahedron with four plane faces; it considers that the lithosphere has been subjected to a slight tetrahedral deformation, to an extent indeed only faintly (if at all) indicated by geodetic measurements, but yet easily recognizable owing to its influence on the distribution of land and water. As the centres of the flattened faces are nearer the Earth's centre of mass than the edges, the water will collect upon them. The ratio of the area of land to that of water on the globe is as 2 to 5. If on a model of a tetrahedron we colour the five-sevenths of the surface that is nearest the centre, the coloured areas would show where the water would collect if the Earth were a stationary tetrahedron. On the upper face there is a large central coloured area in the position of the Arctic ocean. It is surrounded by a land belt, from which three projections run southward down the three lateral edges. These three land areas taper southward

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* This objection applies also to various later modifications of Élie de Beaumont's principle, such as those of Owen; or to the more than local acceptance of the diaclases of Daubrée, or orthogonal cross-folds of Bertrand.

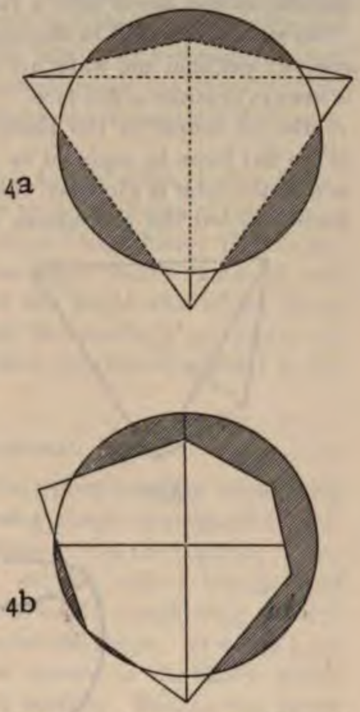

FIG. 4.—RELATIONS OF A TETRAHEDRAL LITHOSPHERE TO ITS HYDROSPHERE. FIG. 4a REPRESENTS THE ARRANGEMENT IN A SIMPLE TETRAHEDRON. FIG. 4b ILLUSTRATES THE CASE OF A MODIFIED TETRAHEDRON (SUCH AS SHOWN IN FIG. 5b), BY A SECTION PASSING ON THE LEFT THROUGH A TETRAHEDRAL COIGN, AND ON THE RIGHT THROUGH THE OPPOSITE TETRAHEDRAL FACE. THE SHADED AREAS REPRESENT WATER.

to a point, below which is a complete belt of sea. South of that, again, is our fourth projecting corner, which is above the water-level, and is the Antarctic continent. So that on the model the general plan of the arrangement of land and water is identical with its actual distribution on the globe. For the land occurs as three triangular equidistant continents, united above into a ring and tapering southwards; there is a great excess of water in the southern and of land in the northern hemisphere; and land and water are antipodal, since in a tetrahedron a corner is always opposite a flat face.

But of course in the Earth the faces are not flat, but are convex. If the flat faces be replaced by projecting pyramids with curved faces, so that the form is globular, the arrangement of land and water remains the same, but the shore-lines are more complex. Green has shown what the shapes of the land and water areas would be in such a tetrahedron. The resemblance between his diagrammatic continent and Africa and S. America, and between his ocean and either the Pacific, Indian Ocean, and S. Atlantic, is very striking.

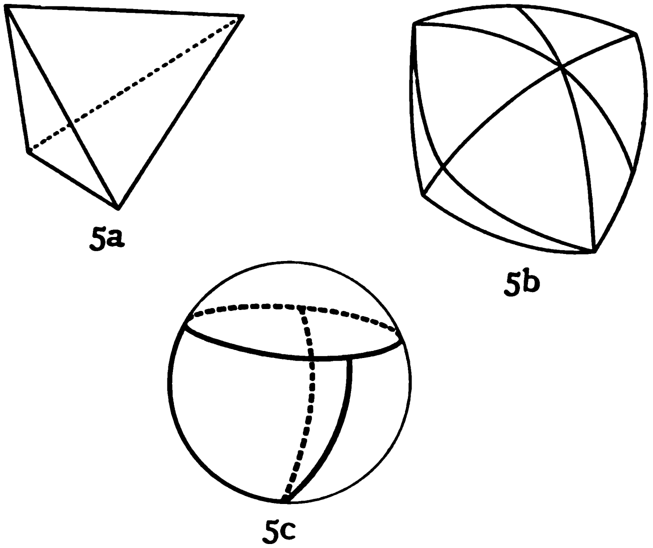

FIG. 5.—5a, DIAGRAM OF A SIMPLE TETRAHEDRON.—5b. DIAGRAM OF A TETRAHEDRON WITH A SIX-FACED PYRAMID WITH CONVEX FACES ON EACH OF THE FOUR FACES.—5c, THE TRACE OF THE TETRAHEDRAL EDGES ON A SPHERE; THE THICK LINES SHOW THE POSITION OF THE TETRAHEDRAL EDGES.

THE TETRAHEDRAL COURSE OF GEOGRAPHICAL LINES.

The agreement between the facts of geography and the tetrahedral theory goes further. The four faces of a tetrahedron meet along six edges, which should be lines of elevation on a globe. The trace of the edges of a tetrahedron on a surrounding sphere form a circle in the northern hemisphere, and three vertical or meridional edges meeting at the south pole. In the Earth the major watersheds have exactly this arrangement. The great watershed of Eurasia dividing the northern and southern drainages, runs, not along the main mountain axis, but far to the north of it, between the parallels of 50° and 60°. The northern and southern slopes of North America are separated by a divide along the same latitude. The southern watersheds, instead of following the lines of highest mountains, or the middle line of the continents, run close to the coast-lines; the three watersheds mark the three vertical tetrahedral edges, and they occur at almost the theoretical distances, 120° apart.

Similarly with the mountain chains. As Sir John Lubbock has pointed out, "in the northern hemisphere we have chains of mountains running east and west—the Pyrenees, Alps, Carpathians, Himalayas, etc.—while in the southern hemisphere the great chains run north and south—the Andes, the African ridge, and the grand boss which forms Australia and Tasmania." That is to say, the northern mountains are parallel to the upper edges, and the southern mountains parallel to the meridional edges of the tetrahedron.

The Cause of the Tetrahedral Plan.

The statement that the elevations of the lithosphere are tetrahedral in arrangement is not an hypothesis, but a simple statement of geographical fact. Is the fact a mere coincidence? On the contrary, there are good reasons why the Earth should acquire such a tetrahedroid symmetry. When the Earth solidified, it would (neglecting the influence of rotation) have contracted into a spherical shape. It would have tended to acquire this form because the sphere is the body which encloses the greatest volume for a given surface. But as the Earth contracts it tends to acquire a shape in which there is a greater surface in proportion to its bulk. Now, among the regular geometrical figures with approximately equal axes, the tetrahedron is that which contains the smallest volume for a given surface. Hence every hard-shelled body which is diminishing in size, owing to internal contraction, is constantly tending to become tetrahedral in form. Fairburn's experiments (quoted by Green) illustrate this tetrahedral collapse for short tubes; and that it is considered probable by some geodists is shown by the following quotation from E. D. Preston: "Nothing is more in accordance with the action of physical laws than that the Earth is contracting in approximately a tetrahedral form. Given a collapsing homogeneous spherical envelope, it will assume that regular shape which most readily disposes of the excess of its surface dimensions, or, in other words, the shape that most easily relieves the tangential strains; for, while the sphere is of all geometrical bodies the one with a minimum surface for a given capacity, the tetrahedron gives a maximum surface for the same condition. Experiments on iron tubes, on gas-bubbles rising in water, and on rubber balloons, all tend to bear out the assumption that a homogeneous sphere tends to contract into a tetrahedron."

THE EARTH A GEOID.

But it may be said this tetrahedral theory is impossible, because we know from our elementary text-books that the Earth is not tetrahedral, but is an oblate-spheroid—that is to say, a sphere slightly flattened at the poles.

The oblate spheroid is no doubt the form that rotation would have caused the Earth to assume as it solidified, if the Earth were quite homogeneous. But the Earth is not homogeneous; it varies in strength and density, and an unequal load on the Earth in any area leads to a divergence there from the circular shape. It is, I believe, now universally admitted that the Earth is flattened laterally at the equator as well as at the poles. The question was long disputed between the astronomers, who, from theoretical considerations, declared what the shape of the world ought to be, and the geographers, whose measurements showed what the shape actually was. There is now a general agreement that the geographers were right; that the equatorial section of the Earth is elliptical, similar to a section through the Earth passing across the poles. The Earth is therefore not a true spheroid, and it was accordingly regarded as an ellipsoid with three unequal axes. But there is good reason to believe that the Earth is not even an ellipsoid; for the northern and southern hemispheres are unlike, and the Earth is therefore shaped like a peg-top. This is shown in two ways. It is a well-known property of the ellipse that degrees measured along the flatter side are longer than degrees measured near the sharper end. It was by proving that a degree of latitude in Lapland is longer than a degree of latitude in Ecuador that the French astronomers in the seventeenth century definitely proved the Earth's flattening at the poles. In continuation of these observations, La Caille, in 1751, measured the length of a degree at the Cape of Good Hope. His measurements showed that the southern hemisphere was also flattened, but to a different extent than the northern hemisphere. This anomalous result of La Caille's was confirmed and extended by Maclear.

The inequality of the two hemispheres has also been shown by the variations of gravity in the two hemispheres, which, as it is more easily tested, has been more widely applied. The principle is simple. A pendulum swings more rapidly the nearer it is brought to the centre of the earth. A pendulum swings more slowly on a mountain-top than at sea-level. It was because Richer, in 1672, found that a clock which kept correct time in Paris lost two minutes a day in French Guiana that the polar flattening was first suspected. So many observations have been made that maps have been compiled showing the variation of the force of gravity throughout the globe. Fig. 6 is a copy of Steinhauser's map, in which the variation of gravity is illustrated by showing how many millimetres have to be added to the length of a pendulum which beats seconds at the equator, to make it vibrate at the same rate elsewhere. In both northern and southern hemispheres the second-beating pendulum has to be steadily lengthened as we approach the poles, but the deviation is at a different rate for the two hemispheres. The surface of the southern hemisphere does not approach the Earth's centre of mass at the same rate as the northern hemisphere. If the Earth's centre of mass is at its geometrical centre, then the Earth's form is elongated southward like a peg-top. It is often held that the Earth's centre of mass is to the south of its centre of form, because of the accumulation of water in the southern hemisphere. It is held that the water is piled up there, owing to the greater density of the southern hemisphere. If that be the case, then the peg-top elongation is all the greater.

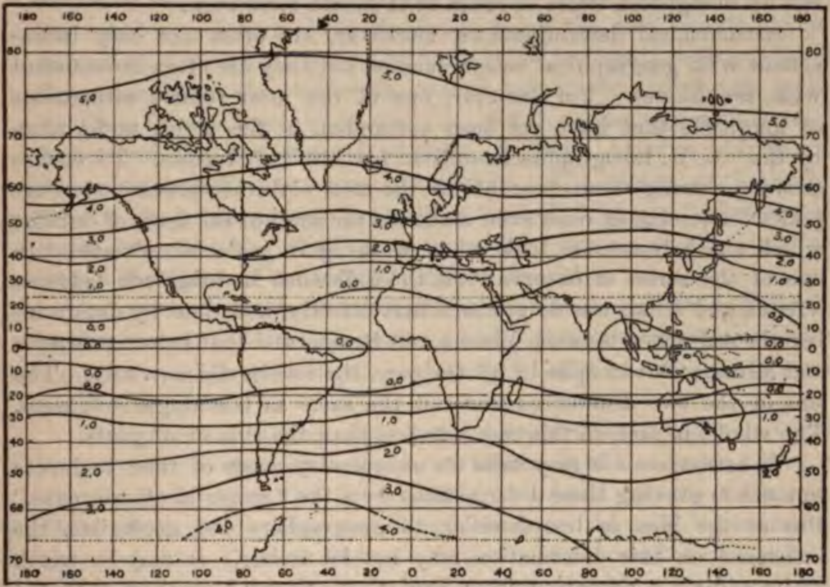

FIG. 6.—STEINHAUSER'S MAP, SHOWING VARIATION IN ATTRACTION OF GRAVITY, AS INDICATED BY LENGTH OF THE SECOND-BEATING PENDULUM. 0 = LENGTH IN EQUATORIAL BELT; 1–5 = NOS. OF MILLIMETRES BY WHICH PENDULUM HAS TO BE LENGTHENED IN ORDER TO BEAT SECONDS AT DIFFERENT LATITUDES.

Moreover, there is evidence to show that the Earth's figure is still more irregular than that of a peg-top.* Sir John Herschel, although taking the astronomical side in the controversy, aptly stated the facts in the statement that "the Earth is earth-shaped." Listing's name of geoid, which expresses this view, has now supplanted the old oblate spheroid from everything except the text-books. That there are local deformations in the Earth's shape is demonstrated by the differences between the astronomical and trigonometrical determination of positions. Places have two different longitudes, the astronomical longitude obtained by astronomical observations, and geodetic longitudes determined by terrestrial measurements; the differences are often considerable. It was calculated, *e.g.*, that the trigonometrical and astronomical determinations of the stations used in the delimitation of the Canadian and United States frontier should have agreed within 40 feet, or 0·4 of a second of arc; but the average error was more than five times as great, and ran up to eighteen times as much as it should have been.

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* As Prof. Darwin suggests, potato-shaped would be a more correct simile.

Astronomical determinations, moreover, are often not only inconsistent with geographical measurements, but they are often inconsistent with themselves. For example, one of the most refined estimations of longitude that have yet been attempted, is the series undertaken by the "K. K. topographische-militär Institut" of Vienna. To ensure accuracy during these observations, the most elaborate precautions were taken. Corrections were even made for the effect of the doses of quinine which the astronomers took when working in malarial climates. In one of the series of observations, the difference in longitude between Vienna and Milan was determined first directly, and then by determining the difference between Vienna and Brescia and that between Brescia and Milan. But in spite of all the care, the results did not tally. The sum of the two differences was not the same as the single difference. The whole, in fact, in this case was less than the sum of its parts.

To astronomers it may seem an unnecessary waste of time to devote so much to proving these deformations from the "spheroid of reference." But as the idea is less familiar to geographers and geologists, the insistence on this deformation may not be useless. It may be worth while adding a quotation from Prof. C. A. Young,* to show that the spheroid of reference is only a convenient assumption. "On the whole," says Prof. Young, "astronomers are disposed to take the ground that since no regular geometrical solid whatsoever can *absolutely* represent the form of the Earth, we may as well assume a regular spheroid for the standard surface, and consider all variations from it as local phenomena, like hills and valleys."

As deviations from the assumed spheroid of reference exist, it remains to inquire whether there is any evidence that they agree in position and arrangement with the theory of the tetrahedral deformation of the lithosphere.

The evidence already quoted of the dissimilarity between the northern and southern hemispheres and the elongation of the latter, is geodetic proof of the northern flattening and the antarctic projection, *i.e.* of one face and one tetrahedral corner.

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* C. A. Young, 'General Astronomy,' p. 101. 1889.

The three flattened lateral faces and three projecting vertical edges are sufficiently demonstrated by the three great oceans and the land-lines that divide them. Practically, all the theories agree upon that point. It is well known that gravity is greater than was expected at most oceanic islands. Lallemand and de Lapparent have suggested that this is due to those islands being below the level of the ordinarily accepted figure of the Earth, and therefore nearer the Earth's centre of gravity.* Fisher has suggested that the Pacific Ocean is the hollow left by the loss of the material which forms the moon. Faye has explained the ocean basins and the greater density of the crust below them as due to more rapid refrigeration below the cold oceanic abysses. According, therefore, to Faye, the rocks below the oceans contracted more than those below the continents, became denser, and accordingly sank.

Thus from all points of view the three oceans represent areas of depression, and the three land-lines of South America, Africa, and Australasia mark intervening projections. The oceans mark the low areas in the lithosphere as obviously as the bubble of a spirit-level marks its higher end; and they give, therefore, evidence of the triangular lateral flattening of the southern half of the globe.

But as, on the mathematical figure of the Earth, such lateral flattening is more improbable than variations along the axis of rotation, let us consider whether there is any geodetic proof of these flattened faces and projecting edges.

There has been a long controversy as to whether Bessel's or Clark's ellipsoid better represents the figure of the Earth. Clark's figure was the later in date, and is generally considered as the more exact. Helmert therefore expresses some surprise that the gravitational observations in Central Europe along the 52nd parallel of north latitude agree with Bessel's curve better than they do with Clark's; this is the case all across the area on which Bessel's own work was done. But as soon as we get into the Volga basin, the gravity line diverges from Bessel's curve and approaches that of Clark. The change comes due north of the Eurafrican meridional edge. The anomalies are at once removed if we assume that both ellipsoids are locally correct; that Bessel's curve is true for Europe, and Clark's correct for Asia; and that the two merge into one another north of the line of the Eurafrican tetrahedral edge.

On the tetrahedral theory, there ought to be a projection north of this tetrahedral edge. And gravity determinations show a great deficiency in gravity in Western Russia in an appropriate area along the Volga basin. It is true that the figures have been queried. There is a natural tendency to query all facts that do not agree with theory, and the notes of interrogation in this case may illustrate that tendency. But on the view that there is an upward deformation of the Earth in this area, the anomalous deficiency in gravity observations is at once explained.

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* This explanation is inadequate, as it does not explain the deviation of the pendulum on coast-lines towards the ocean. The excess vertical attraction of the islands has been explained as due to the attraction of the mass of the island and its base.

It may be replied that the existence of a normal gravity attraction at Moscow negatives the assumption of a superficial deformation; but the relative excess of attraction there is possibly due to the outcrop of Palæozoic rocks, of greater density than the loose sediments of the Russian lowlands.

Passing from Russia to the area in North America, where the next tetrahedral corner should occur, there is another area of deficient gravity, which may also be due to that area being a tetrahedral elevation. The deficiency is explained by the assumption of vast subterranean blocks of very light material. But that explanation is prohibited in the Russian case, since, as Helmert has shown, the deviations of a plumb-line from the vertical are inconsistent with the existence of such blocks. In reference to the North American case, Helmert has remarked that the light subterranean blocks must descend for several kilometres; and Mildenhall has shown that no reasonable assumption will suffice to explain the facts.

It would be too much to claim that geodetical evidence at present available proves the tetrahedral theory, for accurate data are not yet available for a sufficient proportion of the Earth to show whether the major deviations are based on a regular plan; but papers, such as that of Mr. E. D. Preston, show that geodesists are more inclined to regard the theory with favour. It is at least clear that geodesy does not disprove the hypothesis, and that some puzzling geodetic anomalies receive a simple solution if the theory be true.

GEOLOGY AND THE TETRAHEDRAL COIGNS AND EDGES.

Let us now turn to geology, to see if its evidence as to the past history of the world refutes or supports the theory.

The geological evidence ought to be of especial value, as we should expect it to determine the position of the tetrahedral coigns on the face of the Earth.*

If the tetrahedral theory be true, the four tetrahedral coigns should be areas of unusual stability and strength. Comparison of the three meridional land-belts shows that each of them begins in the north with a vast block of archean rocks. The Eurafrican zone, in longitude 20° E., begins with the block occupying Scandinavia, Finland, and Lapland, which Suess has termed the "Scandinavian schild." It is an area of great geological antiquity, which has long remained above sea-level; bands of marine deposits of different ages sweep round it, but the block may never have been below sea-level. It has unquestionably remained as a solid impassive block, which has dominated the whole geological history of Northern Europe. South of the Scandinavian coign are the transverse east and western chains of the Alps and the Atlas, with the Mediterranean trough between; and far to the south we have the old plateau of South Africa.

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* They were assigned to their geometrical positions by Green, and in the interesting recent tetrahedral volcanic map of M. Michel-Lévy.

Let us now go 120° westward to the American zone. It begins with another block of old archean rocks, forming what Suess has called the "Canadian schild." It occupies Canada, Labrador, and most of Hudson bay and Baffin's Land, and underlies Greenland. Bands of marine deposits surround it, but it has perhaps never been itself below sea-level; its geological age, at any rate, is enormous. South of the North American coign we have again a pair of east-west mountain chains, forming the highlands of Cuba and Venezuela, separated by the Caribbean trough. This zone also ends southwards in an old plateau resting on archean rocks.

The third meridional zone repeats the same characters. It begins with a block of archean rocks, for which we may speak as the "Manchurian coign." South of this coign are the east and west ridges of Malaysia and the depressions parallel to them; and south of that, again, we have the archean plateau of Australia.

The three main land axes of the world have remarkable resemblances in structure, and they present three equidistant blocks of great stability at the three tetrahedral corners. We may, therefore, speak of the "schild" as the three northern coigns or corner-stones of the Earth.

The existence of these massive coigns* at the three tetrahedral corners has produced one point of divergence in the Earth-plan from the geometrical figure of the tetrahedron. The existence of three such broad massive blocks naturally strengthens the line between them; and, as we have seen, the main divide in the northern hemisphere runs from coign to coign. The tetrahedral edges would naturally be lines of weakness and of movement; but in the northern hemisphere, the horizontal lines of yielding are deflected southward by the stability of the band supported by the Earth's three northern coigns. Hence the great band of disturbances is subtropical, and runs from the Caribbean to the Mediterranean, across the Persian gulf and the Malaysian archipelago.

In the case of the vertical edges, however, the agreement in position, as well as direction, is exact. Precisely below the three corner blocks, there are three lines of instability coinciding with the vertical tetrahedral edges. Below the Canadian coign there is the line of the Andes (long. 75°), which, according to some geologists, is still undergoing elevation. Almost 120° east of the Andes, and below the Scandinavian coign, is the Erythrean rift-valley (mean long. 40°), in which some of the Earth-movements are unquestionably of very recent date. Again, nearly 120° eastward, and due south of the Manchurian coign, is the recent line of movement represented by the eastern coast of Australia.

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* The suggestion of the word "coign" for "corner" I owe to Mr. L. Fletcher, to whom I am indebted for much helpful advice. The term is suitable, as it is used for a printer's wedge as well as for the corner-stone of a house.

The main mountain system of the world corresponds, then, in direction or position, or in both, with the edges of the tetrahedron. The mountain lines run east and west in the northern hemisphere, and run meridionally in the southern hemisphere—that is, always parallel to the tetrahedral edges.

But it will be said there are three great exceptions, for the Ural mountains, the Appalachians, and the Rocky mountains are meridional instead of transverse, and that they therefore contradict the scheme. The contradiction is only apparent. The existing mountain ranges date from two main periods of mountain-building—the Upper Cainozoic and the Upper Palæozoic. The Upper Tertiary system includes the Alps, Andes, Himalaya, Pyrenees, Caucasus, and Atlas, etc. The Urals, Rocky mountains, and Appalachians belong to the Upper Palæozoic system. Before we can say whether these chains confirm or refute the tetrahedral theory, we must determine the distribution of land and water at the time when they were made.

Now, we know that in upper Palæozoic times one land fauna and flora ranged round the southern hemisphere from Australia to India, and thence to the Cape and South America. Instead of there having then been a continuous ocean-belt separating triangular points of land, there was then a southern land-belt, which was supported by three great equidistant corner-stones, the archean blocks of South Africa, of Australia, and of Patagonia and the Patagonian platform.

What the south pole was doing then is hidden by our deplorable ignorance of that area; but there is evidence that to the south of this southern land-belt there was a cold, ice-laden sea.

Now let us consider the state of affairs in the arctic regions at the same period. At the present time the mollusca of the Behring sea and North Atlantic belong to two essentially distinct faunas. But in upper Palæozoic-Triassic times, one fauna occupied both regions, and that fauna moreover extended uninterruptedly round the northern hemisphere, and apparently, along certain lines, extended some distance to the south. There was, in fact, a northern ocean-belt, which apparently surrounded a cold arctic land. The distribution of the land and water was then on the same plan as at present, but with land and water exactly reversed. There were two opposite interlocking belts of land and sea, the former based on three archean corner-stones, the latter projecting toward the equator between three archean plateaux.

Thus the plan was the same as at present, but the conditions were reversed. This gives us the clue to the mountain chains of the same period. That also was a double system. There was a sub-tropical mountain girdle, the ruins of which we can trace right across the old world from Eastern China to Western Europe, where it is cut off by the Atlantic slope. And projecting meridionally from that equatorial girdle, opposite the three coigns, we have three mountain ranges running along the meridional edges. These are the Ural mountains (60° E.) north of the eastern continuation of the South African coign, the Appalachians (80° W.) north of the western part of the old Patagonian coign, and the old broken axis of Kamtschatka (160° E.) north of the coign of Australasia.

Deformation and Recovery.

Such a change in the position of the flattened faces is by no means improbable in the case of a revolving globe. In the case of a stationary body, a tetrahedral deformation once begun would be strengthened by every fresh contraction. But owing to the world's rotation, the tetrahedral collapse is steadily resisted, and confined within narrow limits. The deformation formed by one period of slow, quiet contraction may be lost on the restoration of equilibrium at an epoch of great crustal disturbance. When deformation begins again in consequence of renewed contraction, the flattening may occur elsewhere.

This hypothesis of the alternation of periods of deformation with periods of spheroidal recovery is geologically useful, as it suggests an explanation of a certain periodicity in geological phenomena. For instance, the later half of Palæozoic time may have been a time of slow tetrahedral collapse, culminating in an instability which led to the great mountain movements which closed the Palæozoic; then followed a quiet period of slow restoration of the spheroidal form, causing the series of marine "transgressions" which are the dominant feature of the geological history of the Mesozoic era.

Vertical Range of Deformation.

Reluctance to admit the possibility of such changes is reduced when we recollect how insignificant are the differences in level, when compared with the size of the Earth. The use of exaggerated diagrams leads to unconscious magnification of the extent of the polar flattening, and of the difference between the continental summits and the oceanic depths. The study of large-scale maps has been authoritatively recommended. The examination of true scale curves and outlines may help us to realize the actual conditions. The accompanying figure * shows a section of the Earth's crust from Stromboli to Vesuvius. The thick black band represents the section across the Mediterranean; the line *ab* marks the depth of the Atlantic; the upper curve shows where the surface would be if there were no polar flattening. The lowest line marks the depth of one-hundredth of the Earth's radius. The thickness of this zone in comparison with the size of the Earth is shown on Fig. 7, *b*, which is a sector of a circle, with the zone of *a* shown, reduced to its true relative size. The polar flattening is barely recognizable, and the difference between sea-bottom and mountain summit is marked only by variations in the thickness of a line.

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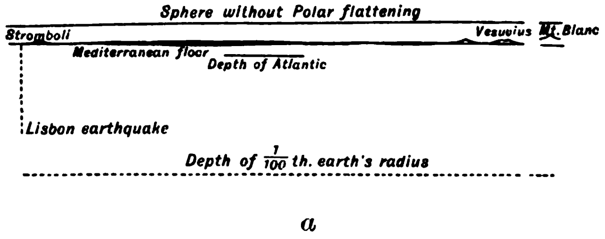
* Based on Lingg's 'Erdprofil.'



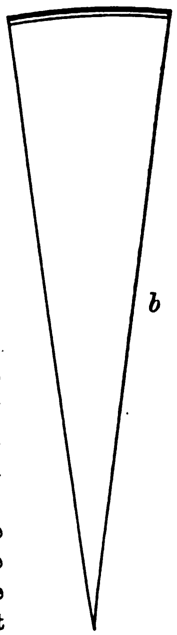


FIG. 7.—DIAGRAM OF RELATIVE EXTENT OF INEQUALITIES ON THE EARTH'S SURFACE. *a*, A TRUE SCALE CURVE OF PART OF EARTH'S SURFACE; *b*, SECTOR OF CIRCLE, SHOWING RELATIVE SIZE OF ZONE INCLUDED WITHIN *a* TO THAT OF THE EARTH.

The diagram illustrates the insignificance of the deformations required; and that crustal disturbance occurs much deeper than the layer with which the tetrahedral theory is concerned is shown by the fact that the estimated centre of origin of the Lisbon earthquake lies far below.

This diagram also serves to show that the amount of contraction in the Earth necessary to allow tetrahedral deformation is very small. This is important because, as Lord Kelvin has shown, the amount of contraction allowable during the later stages of the Earth's history is very limited. But geologists have the authority of Prof. Darwin for accepting a certain amount of contraction. "A cooling celestial orb must contract by a perceptible fraction of its radius after it has consolidated," he tells us, and his considerations "only negative the hypothesis of any large contraction of the Earth since the Moon has existed." * And, unlike the contraction theory of the origin of mountain chains, the theory of the tetrahedral deformation of the lithosphere requires only a small amount of radial contraction.

Finally, it may be urged that even such deformation as the tetrahedral theory requires is impossible, since physicists have taught us that the Earth is rigid. To this objection it is only necessary to reply that Lord Kelvin's rigidity arguments apply to the Earth as a whole, and not to its crust; they deny the fluidity of the interior of the Earth, and do not prohibit any local deformations of the exterior crust. The once prevalent astronomical belief in the absolute invariability of the Earth's shape and in the absolute fixity of its axis of rotation (expressed, *e.g.*, by Sir J. Herschel in 1862) no longer hinders progress. In fact, astronomers tell us that, instead of the absolute fixity of the pole, it now shifts its position to an appreciable extent under the influence of the movements of the atmosphere, the unequal melting of the polar ice, and by heavy falls of snow on the Siberian highlands. These movements of the pole are important, because they are taken to prove a certain elasticity in the Earth. The movements demonstrated by actual observations are so far minute; but they at least allow geologists to say that, as such slight causes as those mentioned produce appreciable effects, more powerful causes acting for longer periods would work greater changes.

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* *Phil. Trans.*, vol. 170, pp. 522, 523.

SUMMARY.

The object of the paper is to show that the old belief in a definite plan of the Earth is justified, since the distribution of land and water on the globe has been determined by the tetrahedral arrangement of the elevations and depressions in the surface of the lithosphere.

This tetrahedral plan is shown by the existence of (1) a northern land-belt, surrounding a northern ocean, and giving off three meridional land lines, which taper southward; (2) the southern ocean belt surrounding a south polar continent, and the three meridional oceans; (3) by the antipodal position of land and water; (4) by the course of the main watersheds and mountain chains.

It is held that this arrangement was not established in the Earth's infancy, and therefore has to be attributed to some agency which has acted throughout geological history.

There are reasons for believing that a contracting sphere with a hard crust would undergo tetrahedral deformation, and the evidence of geodesy shows that the Earth has been deformed from its spheroidal form. Its present figure may be defined as a geoid, which has been derived from a spheroid by irregular tetrahedroid deformation.

If such tetrahedral collapse be granted in the case of the Earth, then the existing arrangement of oceans and continents receives a natural explanation.

The changes in the distribution of land and seas in the past may be explained as due to the conflict of two opposing forces, collapse caused by the Earth's contraction producing deformations, which are reduced by the effects of the Earth's rotation. Geological history affords evidence of the alternation of periods of tetrahedral collapse and spheroidal recovery.

The plan of the Earth may, in short, be attributed to the continual foundering of the Earth's external shell, owing to the unceasing shrinkage of its internal mass.

After the reading of the paper, the PRESIDENT said : In inviting the discussion of this paper, I believe that there are those here who have given some thought to the subject, and who will at least be inclined to tell us what their impressions are respecting the views set forth in Dr. Gregory's paper. I hope Sir John Murray for one will be disposed to give us the result of his impressions on the subject, and also Mr. Blanford.

I find there is a reluctance on the part of learned men to commit themselves to any opinions on a question which at present is in its infancy, and on which their views are not entirely settled. I think that some parts of the paper might have been discussed, and I cannot help expressing, as I have done on other occasions, my regret at the loss we have sustained in our lamented friend General Walker, for there is no man who could have spoken with so much authority on one or two points, especially on the very slight differences that have occurred between astronomical observations and geodetic measurements. As Mr. Whittaker, the President of the Geological Society, is present, perhaps he would be disposed to address us.

Mr. WHITTAKER : I came to listen, not to speak. I found a little time ago that many gentlemen have come here after having the pleasure of seeing the proof. I am not one of those, and were I to speak it would be without the advantage they have had ; consequently they would have the pleasure of sitting upon me, and this goes against my feelings. I would offer one general remark—it is the satisfaction I feel with any paper of this sort that shows the interdependence of the various sciences, and how men who follow one branch of science should not have too much of that branch alone, but should see occasionally how it bears on others, and, on the other hand, how others bear on it. This calls in geologists, physicists, mathematicians, and many others, and it is too big to take up without a chance of going into the matter beforehand, and I decline to commit myself to details.

It is uncomfortable to think that, instead of being on a comfortable globe, as we had imagined, one is placed on a tetrahedron.

Mr. VAUGHAN CORNISH : The tetrahedral theory was described by Mr. Lothian Green. When it was first promulgated it attracted very little attention, and no favourable attention ; it was met almost with ridicule, and I think that it is, perhaps, not the smallest part of our indebtedness to Dr. Gregory that his great power of exposition has brought this theory again before the world, and though he has not yet secured for it a universal assent, he has at least secured a very careful consideration of what must, at all events, be considered a most substantial hypothesis. I think those who have followed carefully the able exposition of Dr. Gregory given to-night, must admit that the tetrahedral convention, at all events, represents the observed distribution of land and water upon the surface of the globe. That distribution is essentially hemihedral, as they say in crystallography ; the forms are not whole forms, but two half-forms interpenetrating, as we see in the oppositely directed wedges of the continents and oceans, and so far, I think, we shall most of us be prepared to go with Dr. Gregory. With regard to the physical causes which have produced such a deformation of the assumed spheroid, I think most of us will wish to reserve our judgment until mathematicians and physicists and followers of experimental science have tested it quantitively, and have seen whether these causes, which I suppose would go in the direction of producing tetrahedral, or tetrahedroïd, deformation, are sufficient to produce the effects that Dr. Gregory has described.

The PRESIDENT: I think we shall all be agreed that this difficult subject, about which so few people seem inclined to give an opinion, has been set before us in a very clear and graphic manner and with great ability by our friend Dr. Gregory. I am sure you will all be ready to pass a vote of thanks for his most interesting paper. Although we are now almost for the first time realizing that the shape of the Earth is not what it is said to be in the text-books, we may remember that the first person who supported the theory that the Earth was the shape of a peg-top or a pear was Christopher Columbus, although he did not put the pointed end of the pear at the south pole, but near the region where the Venezuelan arbitration is going to take place. I now wish to ask you to pass a cordial vote of thanks to Dr. Gregory for his paper.

EXPLORATIONS IN ICELAND DURING THE YEARS 1881-98.*

By Dr. TH. THORODDSEN.

WHEN I was asked to write a brief account of my explorations in Iceland, together with a *résumé* of the geography of the island, I felt that in complying with the request I was undertaking a task which was anything but easy of fulfilment. To compress the results of seventeen years of observation and study into the compass of a short article is to lay one's self open to the charge of being superficial or sketchy, dry or dull. I therefore crave at the outset the reader's indulgence for merely touching upon several topics which, if only they could be treated at greater length, would almost certainly gain in clearness. For the sake of such as take an interest in the geography of Iceland, I will cite, in a series of footnotes, the sources which contain the accounts of my various investigations and journeys throughout the island. As those papers likewise give full information about both the geographical and geological investigations of other authorities, I trust that this present paper, although short, will serve as a sort of key to all that has been done in the field of Icelandic exploration. My own labours are scattered through many different periodical publications, some of them not readily accessible. Unfortunately, I have not hitherto been able to command the time to gather up my results into works of a more ambitious character. It will require several years for me to digest and work out properly the vast amount of scientific material of every kind which I have collected in the course of my journeys. I trust, therefore, I shall not be considered presumptuous if in this article I make bold to refer to those portions of my labours which I have been able to place on record in this or the other publication.

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* Translated by J. T. Bealby, B.A. A new map of Iceland, from data supplied by Dr. Thoroddsen, will accompany the second instalment of this paper.

Although Iceland lies comparatively close to Europe, and although it possesses natural features which are in many respects remarkable, it cannot be said that the island is at all well known, certain relatively small portions of it alone excepted. Merely a fractional part has been visited by scientific inquirers. The majority of the visitors to Iceland follow the beaten tracks through the more accessible districts. Very few have enjoyed either time or opportunity to penetrate into the uninhabited and desolate interior. And there are many of the more inaccessible parts of the coast quite as much unvisited as the central region.

That Iceland has never previously been thoroughly examined is due to a variety of causes—its vast extent, its peculiar physical features, the sparse population, the unfavourable climatic conditions, the limited portion of the year during which it is possible to carry on investigations.

The uninhabited interior of the island, constituting more than one-half of the entire area, lies at an elevation of 1500 to 3000 feet above the level of the sea. The surface is covered by lavas, rocky *débris*, drift sand, and jökler, or ice-mountains. At such an altitude, so near the polar regions, the climate must necessarily be harsh. Vegetation is extremely scanty; for many miles on end there is not a blade of grass for a horse to pluck. It is also very difficult travelling in certain of the remoter portions of the coast, owing to its stern and rugged character. On the other hand, it is the easiest thing in the world to travel through the relatively thickly peopled districts of the south and the north; both are, in fact, visited every year by a respectable number of tourists.

Before we could say that this island was tolerably familiar to us two things were essentially necessary; first, a systematic geographical examination of the uninhabited interior; secondly, a geological reconnaissance of the entire island. It is true that several distinguished geologists have at different times visited Iceland, and published admirable accounts of what they have seen and observed; it is also true that certain particular districts have been examined again and again. Nevertheless, these inquirers have seldom spent more than a short time in the island, and consequently have gone away leaving vast stretches of it altogether unexplored. We possessed no general description of the geological structure of the island as a whole; nor, indeed, could we possess such, seeing that upon four-fifths of its surface no trained geologist had ever set foot. What was needed, then, was a general view of the physical geography and geological history of Iceland.

In the year 1881, I conceived the idea of trying to fill up piece by piece some of the biggest gaps in our knowledge of the geography and geology of Iceland. Considering the extremely modest resources I had at my command, I could scarcely hope to examine the entire island. The task I set myself was to go systematically to work, and, instead of making a hasty survey of a large area, to confine myself to relatively narrow districts, examining one or more every year as thoroughly as I was able. By adopting this plan, I hoped, with patience, to gain a tolerably accurate knowledge of some of the less-known quarters of the island; and, time and opportunity favouring me, I might possibly go on, and in this way gradually lay the foundations for a general survey of the whole country.

The first nine years I was sadly hampered through lack of means; but as time went on, this hindrance was gradually removed. First, the Icelandic Althing made me a grant. After that the Danish Rigsdag and two private gentlemen—Mr. Oscar Dickson, of Gothenburg, and Mr. A. Gamél, of Copenhagen—generously provided me with the means to procure a better equipment; so that I was enabled to continue my work under much more favourable conditions than before. Thanks to this valuable support, I succeeded, during the years 1881–98, in travelling over and exploring the entire island.

DR. THORODDSEN AND MR. SIGURDSSON STARTING.

My first object was to acquire a pretty accurate knowledge of the interior of the island. The coast was surveyed during the first nineteen years of the nineteenth century by various Danish and Norwegian naval officers. In the years 1831–43 Björn Gunnlögsson surveyed the inhabited districts, as well as took a few trips into the interior. The map of Iceland which he drew up, in four sheets, was an excellent piece of work; but the interior of the island, which was very little known, was laid down from mere observation and the reports of shepherds and others. Indeed, of the area represented on Gunnlögsson's map, some

17,500 square miles, representing the interior, had never been subjected to scientific examination, and certain other regions (including 3500 square miles of the ice-mountains) had never been trodden by human foot.

Amongst the latter I may especially mention a portion of Odádahraun, the desert regions north-east of Fiskivötn, besides a few other places scattered up and down the island. The sources of several of the larger streams had never been seen, and the situation of some of the large groups of lakes was uncertain. My first immediate object then was to obtain a general and reliable view of the topography. At the same time there were also a number of geographical and geological questions urgently demanding solution. I intended, amongst other things, to collect materials for a geological map, on which I hoped to indicate with tolerable accuracy the extent of the several formations and species of rocks; in the next place, to attempt to trace out the broad lines of the structural history of the island; to examine and map the volcanoes and lava-streams, to study the history of the volcanic eruptions, as well as the origin, distribution, and geological relations of the warm springs, solfataras, and earth-tremors. In addition to these objects, it would also be desirable to make observations upon the modern glaciers, the altitude of their snow-line, their glacial changes and formations, the glacial scratchings, the marine deposits, marine terraces, and so forth. When I embarked upon this enterprise, I fully realized the magnitude of the task I was setting myself. I knew full well how audacious it was for a single private individual, with such limited resources as I possessed, to attempt the exploration of a country stretching over an area of 40,450 square miles, possessing an arctic climate, and being in many parts extremely difficult of access. But I took courage from the Horatian maxim—

> "Est quadam prodire tenus, si non datur ultra,"

and counted upon the friendly consideration of my scientific colleagues over sea to extend to me that indulgence which is one of the brightest features of the modern scientific world. In a word, I hoped that generous allowance would be made for the difficult circumstances under which I worked. Iceland is destitute of scientific institutions and laboratories. For many years I never had opportunity to exchange a word with anyone who had an interest in geology. I am, therefore, all the more deeply grateful to those men of science in both America and Europe who have encouraged me by letters and helped me with presents of books.

Before beginning my real work of exploration, I deemed it essential to make myself familiar with the labours of my predecessors, and with all that had been written about my native island. There exist a good many books about Iceland, written in both ancient and modern times, besides a number of separate papers, scattered through Icelandic, Scandinavian, and other periodicals. These, of course, vary greatly in value. In addition to these printed sources, there also exist in Icelandic and Danish libraries a large number of little-known manuscripts, containing a good deal of information about matters of interest relating to Icelandic geography, national life, and means of subsistence in ancient times and in modern. I have made it my duty to unearth all these sources whilst carrying on my own investigations. But seeing how vast is the material, and how widely different its constituents are in character and value, as well as how extraordinarily inaccessible a good deal of it is to ordinary inquirers, I have deemed it advisable, in the interests of future students and investigators into the geography and *kultur-historie* (social history) of Iceland, to gather them up into one collective publication,* which is now in process of being published in Icelandic and German.

I will first enumerate briefly the several exploring journeys which I made through Iceland during the period already mentioned, referring to the accounts of them published in divers periodicals.

As I have already remarked more than once, my first object was to explore the interior. Now, as the interior consists for the greater part of deserts, lava-fields, and glaciers, and as it is almost entirely destitute of vegetation, exploring trips in that direction obviously demand both time and patience,† as well as a good equipment of tents, provisions, horses, instruments, and so forth. Most of the earlier attempts to explore the most difficult parts of the interior failed from want of grass for the horses. To carry sufficient fodder to last over a prolonged stay in the high-lying desert regions is an absolute impossibility. The large expedition which was sent out in 1840, under the leadership of T. C. Schythe, in order to explore the southern part of Odáđahraun, was unsuccessful from that very cause—want of grass, coupled with snowstorms. Nearly all the horses died, whilst the members of the expedition barely struggled back to the inhabited districts alive.‡ Others which followed had no better fortune. With the view of avoiding a failure from the same cause, I went to work on a plan which had not previously been attempted. I never carried hay with me from the settled districts. Scattered round the outer border of the interior plateau there are a few small oases yielding scanty supplies of grass. These are known to certain shepherds and others, who in autumn have had occasion to follow straying sheep into the desert wilds, and I got them to tell me where these spots were situated. The knowledge thus obtained proved extremely useful to me in my expeditions. Although frequently not greater than a few score chains square, these patches of grass served for camping-grounds, and temporary centres from which to make flying excursions to this or the other point of interest in the immediate vicinity. I used to take a scythe and rake with me, mow the grass, pack it into sacks, and in that way carry it as food for the horses whilst journeying from one oasis to another. As a rule, the desert wastes between the oases could be traversed in from two to three days. My equipment was in nearly all respects typically Icelandic, although during the first nine years, owing to lack of pecuniary means, extremely primitive and inadequate. I and my attendants lived upon the plain ordinary food of the Icelandic peasant. During our tent life in the interior we drank large quantities of coffee, but no alcoholic liquors. Surveying in the interior of Iceland is wont to be frequently interrupted by bad weather—rain, fogs, storms of sand and snow. Owing to fog, I often had to ascend the same mountain several times before I was able to get a proper observation for measurement. In fact, the principal *desiderata* for successful exploration work in the interior of Iceland are a thoroughly good equipment and an unlimited stock of patience.

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* 'Landfrædissaga Islands' (Reykjavik and Copenhagen, 1892-98). 'Geschichte der isländischen Geographie,' German translation by Aug. Gebhardt (Leipzig, 1897-98). Two volumes are already published. The third and last volume is not yet printed.

† "Icelandic exploration is 'chancy' as Central African, and the traveller must expect to be the sport of circumstances far beyond his control, unless, at least, he can afford unlimited time" (Richard F. Burton, 'Ultima Thule,' vol. ii. p. 325).

‡ *Kröyers Naturhistorisk Tidskrift*, iii., 1841, pp. 331-394.

In the year 1876, I took part in Prof. Johnstrup's expedition to the northern parts of the island, to study the volcanoes at Mývatn and the volcano of Askja. My own independent investigations I began five years later, in 1881, when I made a hurried journey obliquely across the island, working in with it trips to the south-west corner, where I studied the volcanoes and warm springs near Œlfus and Thingvallavatn.* I made my first long exploring journey in the summer of 1882, and with it began the execution of my plan, my former expeditions having partaken more of the nature of trial trips.† That year I went from Akureyri to Mývatn, and thence to the fjord districts of Eastern Iceland; besides which I made two or three excursions into the interior—for example, to the east side of Hofsjökull, which no traveller had previously visited. Amongst other work which I accomplished on that journey, I investigated the well-known "double spar" quarry at Reydarfjord, in the vicinity of Helgustadir, mapping it and taking drawings of it in profile.‡ But the year 1882 was for several reasons unfavourable for travel. The whole of the north coast was blocked by the Greenland drift-ice until the very end of August. The summer was so cold that very little grass grew, and some of my horses broke down. In addition to these drawbacks, the entire island was ravaged by an epidemic of measles, which carried off nearly two thousand people. Wherever I went there were sick folk, so that but little assistance was to be procured. Before the end of the journey my own men fell ill, and I was obliged to bring my summer's work to an abrupt termination.

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* Th. Thoroddsen, "En Udflugt i det sydvestlige Island," in *Geografisk Tidskrift*, vi. pp. 135–139.

† Th. Thoroddsen, "En Undersögelse 1882 i det östlige Island," in *Geogr. Tidskrift*, vii. pp. 95–112, 129–140. Translated into German in *Die Natur*, 34ten Jahrgang (Halle, 1885); *Petermanns Mitteilungen*, 1884, pp. 422–426; *Andvari*, ix. pp. 17–96.

‡ Th. Thoroddsen, "Nogle Bemerkninger om de islandske Findesteder for Dobbelspath," in *Geol. Fören. Förhandl.* (Stockholm), xii. pp. 247–254. German translation in *Himmel und Erde* (Berlin, 1891), iii. pp. 182–187.

In the summer of 1883 I explored the peninsula of Reykjanes. Although lying so near to Reykjavik, the greater portion of this remarkable volcanic peninsula had never been visited by a geologist. Except for a few fishing-stations along the coast, it is almost entirely buried under lava, an uninhabited and barren waste. Although it was no easy matter to use horses in that region, owing to the uneven surface of the lava and the numerous rents in the ground, I nevertheless managed to cross it backwards and forwards sufficiently to examine its remarkable geological conditions. I counted some thirty volcanoes, with over seven hundred craters of different sizes, as well as a great number of volcanic fissures, out of which the lava had flowed. I estimated that the lavas thus ejected covered an area of 730 square miles.*

DR. THORODDSEN'S TENT.

The following summer I spent the time at my disposal in investigating the vast lava desert of Odáðahraun and the adjacent parts of the interior plateau, ranging at altitudes of 1500 to 3000 feet above the level of the sea. The country was difficult to travel through; besides which we had to contend against a deficiency of grass, glacier streams so swollen as to be actually dangerous, and unfavourable weather. In spite of these obstacles, I was successful in ascending the greater part of the mountains, in crossing the desert backwards and forwards, both on horseback and on foot, and in covering it with a network of trigonometrical triangles drawn from mountain to mountain.* That same year I made a trip to the little island of Grimsey, lying off the north coast,† immediately above the arctic circle.

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* "Vulkanerne paa Reykjanes i Island," in *Geol. Fören. Förhandl.* (Stockholm), vii. pp. 148–177; *Andvari*, x. pp. 1–76; *Globus*, vol. lxix.

In the year 1885 I undertook no long journey, but contented myself with short geological excursions in both the north and the south of the island. But in the two following years, 1886–87, I visited the northwest peninsula of the island, and explored its many fjords. During the summer of 1886 I traversed the coast districts lying on the north side of Breidifjördr, where I found a good deal that was of geological interest —well-marked profiles of the basalt formations, deposits of lignite, petrified vegetation, as well as glacial formations and marine terraces. In August of that same year I travelled along the north-east coast of the peninsula, through the so-called Hornstrandir, as far as Cape North (the Horn). The southern portion of that coast had not been visited since the year 1754, when it was traversed by E. Olafsson; the northern portion had never been visited by any traveller. My journey along that coast was the most toilsome of any I have ever undertaken in Iceland. We had wretched weather all the time. The drift-ice had penetrated close in to the shore. The fjords and glens were shrouded in the cold fogs which generally accompany the drift-ice. All August it snowed and rained without intermission; so that we were obliged to quit the tent, and take refuge in the miserable huts of the peasantry. We used up all the provisions we had brought with us, and for several weeks had to live upon half-decayed seafowl, shark's flesh, and such like delicacies of the native inhabitants of the region. When we stumbled upon an occasional bowl of porridge, it came as a veritable feast. We got wet through every day, and had no opportunity to dry our clothes. No wonder, then, that we looked thin and wretched when we returned home.

The inhabitants of these parts of the coast dwell at vast distances apart. The mountain spurs which divide fjord from fjord are lofty, narrow, and very steep, and to climb up and down them entailed severe labour upon both horses and men. In many places the only means of getting up is along mere ribbons of footpath that wind up the faces of the precipices, and demand the utmost caution in moving along them, whilst the surf rolls in with a thundering roar several hundred feet below. At other times the horses had to scramble over slippery blocks of stone down on the very edge of the sea, both horses and men constantly drenched by the bursting waves. At the most dangerous places we were obliged to unload the horses and carry their loads on our own backs, whilst the horses were led across one by one after us. In the valleys it rained without ceasing. On the tops of the mountains it snowed so heavily, that the snow often lay knee-deep, and the horses kept sticking fast in the snow-drifts.

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* [illegible] pp. [illegible] [illegible] No. [illegible] and vol. xxx. No. [illegible] with a map.

† [illegible] vol. xxx. No. [illegible]

The people who inhabit those tracts have a terribly hard struggle to live. During one-half of the year the drift-ice lies wedged up against the coast, or drifts close to it. So much of the summer's warmth is consumed in melting the ice, that it is always cold and raw during that season, and nearly always excessively damp. For this reason the people experience very great difficulty in drying the small quantity of hay they require for their few domestic animals. Their principal means of subsistence is wild-fowling, a dangerous occupation, frequently costing human lives. It would scarcely be possible to conceive anything more lonely and desolate than a cottage on the Hornstrandir. The wretched hut clings like an eyrie to the face of the steep sea-cliffs, several hundred fathoms above the water. No stranger ever shows his face within sight of it. Often the nearest neighbour lives an entire day's

CAPE HORN.

journey distant. The inhabitants are almost entirely ignorant of what goes on in the world, for it is extremely seldom that an odd number of an Icelandic newspaper finds its way into those remote regions.*

I devoted the summer of 1887 to the exploration of the north-west fjords of the same peninsula. Travel on that side of the peninsula is beset with well-nigh the same difficulties as on the east side, especially towards the northern extremity, round about Adalvik, west from Cape North. In that part we were unable to take our horses, but were obliged to make our way entirely on foot. That summer those remote northern districts were suffering from famine, and a malignant form of typhus and scurvy. In the widely separated and poverty-stricken huts, where we spent the nights, there was scarcely any food to be had; and unfortunately we were not able to carry much else with us beyond the instruments we needed most. By good fortune we escaped the infection.

To the geologist that coast presents many features of interest. I discovered several deposits of *surtarbrand*, or lignite (see below), and explored the glaciers which stretch down to the sea from Drangajökull.†

In the year 1888, I directed my investigations to the southern parts of the interior plateau, more particularly the tracts around Langjökull and Hofsjökull. On that journey I was for the most part favoured with fine weather, and in the districts which I visited there were adequate supplies of grass. My first excursion was to the so-called Thjórsárdalur, where the ruins of twenty homesteads remain as melancholy witnesses of a destructive volcanic outburst in the fourteenth century. Here too there was much to interest a geologist. Thence we travelled beside the Hvítá (White river), up into the interior, where I spent several weeks, for I soon perceived that the existing maps of the districts I was visiting needed considerable revision. Whilst examining the liparite mountains of Kerlingarfjöll, I had the good fortune to discover some exceptionally fine solfataras—in fact, the finest in all Iceland. ‡ I also explored the glaciers around Lake Hvítárvatn, the lava-fields of Kjalhraun, and the warm springs at Hveravellir. I made my way home by the north and west roads, and was so fortunate as to discover some hitherto unknown places with fossil plants.§

The next year, 1889, I explored the portion of the interior which was least known, namely, the tracts west of Vatnajökull, including the lakes which bear the name Fiskivötn. In that journey I travelled over long distances which had never before been trodden by human foot. Before visiting them, I believed that the lakes of Fiskivötn, like other similar groups in the interior of Iceland, were of glacial origin—depressions lying between ancient moraine ridges. I was, therefore, not a little surprised to discover that the greater part of them were crater lakes, and that they lay ensconced among a large cluster of volcanoes with extensive lava-fields, forming a link of connection between the volcanic regions of the south and the north of the island. To the north and east of these lakes there was nothing but deserts of sand and lava, utterly destitute of vegetation. We had to carry with us every blade of fodder we needed for the horses. I made several long excursions through those deserts, visiting, amongst other places, Lake Thorisvatn, which I found to be a little over 25 square miles in extent. In the course of another excursion I touched Vatnajökull, discovered the sources of the (river) Tungná, and also a long narrow lake, to which I gave the name of Langisjór (Long lake). On my return journey I came across some extremely interesting currents of obsidian lava.[*]

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* "Fra Islands nordvestlige Halvö," in *Geog. Tidskrift*, ix. pp. 31–50; *Andvari*, xii. pp. 99–203. "Eine Reise nach Nordkap in Island," in *Petermanns Mitteilungen*, 1888, pp. 113–120; *Das Ausland*, 1887, pp. 181-186.

† "Fra Vestfjordene i Island," in *Geog. Tidskrift*, ix. pp. 149–168; *Andvari*, x. pp. 46–93.

‡ 'Neue Solfatara'en und Schlammvulkane in Island," in *Das Ausland*, 1889, pp. 161-164.

§ "En Reise gjennem det indre Island i Sommeren, 1888," in *Geog. Tidskrift*, x. pp. 10–29; *Petermanns Mitteilungen*, 1892, pp. 25-31; *Andvari*, xv. pp. 56–119.

The exploration of the peninsula of Snæfellsnes and the districts at the head of Faxafjord claimed my attention in 1890. There was plenty of scope for geological work. I opened up several fresh fields, discovering, amongst other things, some new beds of liparite, extensive deposits of *nagelflüh*, numerous groups of craters which had never previously been examined by any geologist, warm springs, carbonic acid springs, and similar features.[†] The summer of the following year was occupied with short excursions to the west side of the island, more especially to the neighbourhood of Borgarfjord, where I completed certain investigations which I began in 1890; for instance, observations of warm springs and different glacial deposits and rock-striations.

In 1892 I did no exploring work in Iceland. An illness compelled me to go abroad for the summer. The rest and change, however, restored me to good health.

Next year I worked the county of Vester Skaptafell and the little-known parts of the interior plateau which fringe the south-west slopes of Vatnajökull. Travelling was anything but easy in that quarter, because of the great irregularities of surface of the lava-streams, the broken and rifted character of the mountain ridges, the want of grass, and the drift-sand. In spite of these drawbacks I was successful in penetrating to the sources of the two streams—the Skaptá and the

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[*] "Fra Islands indre Höjland," in *Geog. Tidskrift*, xx. pp. 149–179, with a map; *Petermanns Mitteilungen*, 1892, pp. 189–196, with a map; *Andvari*, xvi. pp. 46–115.

[†] "Snæfellsnes i Island," in *Ymer* (Stockholm, 1890), pp. 144–188. "Geologiske Iagttagelser paa Snæfellsnes og i Omegnen af Faxebugten i Island," a supplement to *K. Svensk. Vetenskaps Akademiens Handlingar*, 1891, vol. xvii. II. No. 2, 96 pp., with map and illustrations; *Andvari*, xvii. pp. 27–118.

Hverfisfljót, which had never previously been visited. I also was the first explorer to examine the mountainous country north of Fljótshverfi. All these districts, and especially the stretch of country between the Tungná and the Skaptá, are amongst the most interesting in Iceland. I investigated the border glaciers of Mýrdalsjökull and the western side of Vatnajökull, and discovered thirteen hitherto unknown glaciers, as well as took the altitudes of the snow-line and of the edges of the glaciers in many places. But the features of greatest interest were the volcanoes. Amongst other notable discoveries I made in that quarter was a gigantic volcanic fissure (Eldgjá), which ran to a length of nearly 20 miles, with a depth of 400 to 650 feet. This fissure has in three different places ejected streams of lava, which now cover a combined area of 268 square miles. Later on in the summer I explored the chain of craters at Laki, amounting to about one hundred in number. They were the scene of a violent eruption in 1783, which left behind it a lava-stream 220 square miles in extent, and having a volume equal to a cube measuring 3 miles along each of its sides. These gigantic outflows of lava have occasioned great changes in the appearance of the country, altering the coast-line and the channels of the rivers. I made a close study of the geological development of this part of Iceland, and embodied the results in a series of maps.*

The summer of 1894 was devoted to an examination of the southern flank of Vatnajökull and that part of the plateau which borders upon the north-east side of the same glacier tract, as well as a portion of the northerly fjords on the east side of the island. For the most part the mountains in the latter region consist of basalt, but there are also a good many dykes of liparite and granophyr. I discovered close upon fifty new deposits of these eruptive rocks. At Lón I studied the gabbro mountains and their relations to other species of rocks. The only places in Iceland where gabbro occurs are the districts adjacent to the south-east corner of Vatnajökull. A great number of large glaciers radiate from the southern flank of Vatnajökull, and the narrow sandy belt of coast between the mountain and the sea is traversed by numerous rivers, conveying considerable volumes of water. I studied the physical conditions of the glaciers, and found that some of them have sensibly increased in dimensions within historic times, as well as moved nearer down to the sea. On the plateau to the north-east of Vatnajökull I investigated other glaciers, as well as discovered some new lakes and surveyed certain of the less-known districts.†

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* "Reise i Vesterskaptafells Syssel paa Island i Sommeren 1893," in *Geogr. Tidskrift*, xii. pp. 167–234, with a map and illustrations; *Andvari*, xix. pp. 44–61; *Verhandl. d. Gesellsch. f. Erdkunde zu Berlin*, 1894, pp. 289–295.

† "Fra det sydöstlige Island," in *Geogr. Tidskrift*, xiii. pp. 3–37, with a map; *Andvari*, xx. pp. 1–83, xxi. pp. 1–33; *Verhandl. d. Gesellsch. f. Erdkunde zu Berlin*, 1895, pp. 185–192; *Petermanns Mitteilungen*, 1895, pp. 288–290.

In the following summer I bent my steps towards the extreme north-east of the island, the peninsulas of Melrakkaslétta and Langanes, and the portions of the plateau which lie immediately behind them. These districts had never previously been surveyed; and they revealed several features of geological importance. For instance, I ascertained that the more recent volcanic formations of Iceland extend very much further to the east than had hitherto been supposed. Here again I discovered and measured some new volcanoes and lava-streams. In the interior I found several chains of tuff hills, as well as rivers and lakes, which had never been shown on any map. Towards the end of that summer's journey I fell ill of typhus, and had to stay some time in a peasant's house. By the time I had recovered and got back my normal strength, autumn was come, and the snow and frost made it impossible to continue my work. However, I had pretty nearly done all I had planned to do that year.*

SOLFATARAS IN KERLINGARFJÖLL.
(*After a sketch by Captain D. Bruun.*)

I next directed my attention, in the summer of 1896, to the northern parts of the island, namely the mountainous peninsulas between Skjálfandi and Húnaflói, and undertook a longer excursion to Arnarfellsjökull (or Hofsjökull), in the interior, for the purpose of exploring districts there which were but little known, including the glaciers. In that quarter the plateau consists for the most part of stony deserts without a vestige of grass, so that we were obliged to carry all the hay for the horses with us.†

In the summer of 1897 I laboured in the southern lowlands of the island, in especial in those districts which were the scene of the violent seismic disturbances of the preceding autumn. My principal object was to gather details that would serve as a basis for a general view of the geology of that region, in the hope that I might thus trace out the cause of the earthquake tremors, and ascertain their connection with the fundamental structure of the island, as also to collect materials for a descriptive account of the disturbance itself. Towards the close of the summer I made an excursion to the north of the island, and travelled through the *sysel* (county) of Húnavatn, studying its geology, especially its glacial deposits.* In the last summer, 1898, I explored the interior plateau north-west of Langjökull and the mountains behind the Borgarfjord.

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* "Fra det nordvestlige Island," in *Geogr. Tidskrift*, xiii. pp. 99–122, with a map; *Petermanns Mitteilungen*, 1896, pp. 269–275; *Andvari*, xxii. pp. 17–71.

† "Fra det nordlige Island," in *Geogr. Tidskrift*, xiv. pp. 7–28, with a map.

From all this it will be seen that I have pretty well travelled over the whole of Iceland—the interior plateau, the inhabited and cultivated parts, the promontories, peninsulas, and fjords, and I have carried through my original plan of making a geographical and geological reconnaissance of the entire country. But seeing that Iceland possesses so many geological features of exceptional interest, I hope, if life is spared to me, to make further special studies of some of the more interesting regions.

Exploration work in Iceland can only be carried on satisfactorily during the months of June to September. On the plateau you can hardly travel much before July. It is only then that the scanty supplies of grass are available; earlier than that the ground is still soft and wet, owing to the thawing of the snow-wreaths. After the middle of September the weather is as a rule rainy and stormy, at any rate in the southern districts, so that travelling becomes difficult on that account.

During the years 1880–84 I was teaching in the "modern" school (*realskole*) at Mödruvellir, near Akureyri, on the north side of the island, and one of my pupils from there, Ogmundur Sigurdsson, who has accompanied me on most of my subsequent journeys, has been of great service to me. Since the latter year I have held an appointment in the grammar school of Reykjavik. The schools in Iceland are closed for holidays from three to four months every summer; these months I employed in travelling about the island. Then by an economical arrangement and employment of my spare time between and after my daily duties (which occupied from six to seven hours) during the winter, I have found time to write the accounts of my several journeys—my books and articles on the geography and geology of Iceland. The last two years I have been allowed to engage a substitute to do my school work. Icelandic scholars have hitherto devoted their attention almost exclusively to the study of Iceland's past, her language, literature, and history. But during the last few years an interest has been awakened in the natural sciences, and some of our younger students have trained themselves in those branches of knowledge at the university of Copenhagen. There is, therefore, every reason to hope that in the future native Icelanders will be able to make contributions towards a thorough knowledge of the physical conditions and phenomena of the island which has given them birth.*

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* "Jordskjælv i Islands sydlige Lavland deres geologiske Forhold og Historie," in *Geogr. Tidskrift*, xiv., with map; *Société de Géographie de Paris—Comptes Rendus des Séances*, 1897, pp. 330–333.

As I have already remarked, one of my principal objects was to sketch a more accurate geographical picture of the plateau regions of the island, based upon surveys of the less known tracts, than we hitherto possessed. The coasts were surveyed in the early part of the nineteenth century, at which time the positions of a number of mountain summits in the vicinity of the coast were trigonometrically determined. These determinations I took as fixed points for my own surveying work. In the interior I linked the more prominent mountain peaks together by means of triangles measured with the theodolite, whilst the details between were filled in by means of the surveying compass. The maps embodying the results of my surveying operations are published in various periodicals.† Up to the present I have, unfortunately, through lack of

HVÍTÁRVATN AND HVÍTÁ.

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* With the view of awakening an interest in the natural sciences in Iceland, I wrote in my mother-tongue, 'Jardfrædi' (Geology) (Reykjavik, 1889); 'Lýsing Islands' ('Description of Iceland,' translated by A. Helland) (Christiania, 1883); besides several papers in Icelandic periodicals.

† I may perhaps be permitted to add a list of the sources in which maps, based on my surveys, have up to the present been published. "Odádahraun," in *Petermanns*

time, had no opportunity to collect and publish them all together, but I hope to do so shortly.

Another important task which I set myself was to determine the heights of as many mountain peaks as possible all over the island. I have measured about eight hundred peaks, but the results in the case of only a relatively small portion of them are as yet published. I hope, however, eventually to make my measurements the groundwork of a hypsometrical map of all Iceland.

A third object was to collect materials for a general geological map of the island. The earliest geological map dealing with Iceland was the map by Paijkull, published on an exceedingly small scale (1 : 1,920,000) in the year 1867, but its chief function was to show the extent of our ignorance as to the geology of the country.* In 1886, K. Keilhack published a general geological map,† embodying the results of his own and others' observations, but as at that time many parts of the island had not been examined, or even visited by any geologist, his map cannot claim to be anything like complete. In the same year A. Helland published a geological map of the county (*syssel*) of Vester Skaptafell,‡ but this too was based to only a very small extent upon actual scientific determinations, and consequently could not claim to be anything like adequate or accurate. These are the only geological maps of Iceland which there were in existence. Nor could any really reliable maps be made until the whole of the island had been systematically visited and studied, and its geological structure investigated. The journeys I have taken have enabled me to issue gradually one after another some thirteen maps,§ delineating the results of my geological surveys. At the present

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Mittheilungen, 1888, plate xiv.; "Fiskivötn and the Neighbourhood," in *Geogr. Tidskrift*, x. plate iii.; "Map of a Portion of the Interior of Iceland," in *Petermanns Mitteil.*, 1892, plate iii.; "The County of Vester Skaptafell," in *Geogr. Tidskr.*, xii. plate ii.; "South-Eastern Iceland," in *Geogr. Tidskr.*, xiii. plate i.; "North-Eastern Iceland," in *Geogr. Tidskr.*, xiii. plate iii.; "A Part of Northern Iceland," in *Geogr. Tidskr.*, xiv. plate i.

* *Svenska Vetenskaps Akademiens Handlingar*, vii. No. 1 (Stockholm, 1867).

† *Zeitschrift d. deutsch. geolog. Gesellsch.*, 1886, plate viii.

‡ *Lakis Kratere og Lavastrømme* (Kristiania, 1886).

§ My geological maps include: "South-West Iceland," in Geolog. *Fören. Förhandlingar*, xi. plate v.; "Ódáðahraun and Neighbourhood," in Mitteil. d. k.-k. geogr. Gesellsch. in Wien, 1891, plate v.; "Snæfellsnes," in a Supplement to *Kongl. Vetenskaps Akademiens Handlingar*, vol. xvii. II. No. 2, 1891; "The County of Vester Skaptafell," in Geogr. *Tidskr.*, xii. plate ii.; "North-West Iceland," in Geolog. *Fören. Förhandl.* (Stockholm), xvii. plate i.; "A Portion of the Interior," in *Petermanns Mitteil.*, 1892, plate iii.; "South-East Iceland," in Geogr. *Tidskr.*, xiii. plate i., and *Petermanns* **Mitteil.**, 1895, plate xx.; "North-east Iceland," Geogr. *Tidskr.*, xiii. plate iii., and *Petermanns* **Mitteil.**, 1895, p. 285; "A Portion of Northern Iceland," in Geogr. *Tidskr.*, xiv. plate i.; "Geological Sketch-map of Landmannaafrjettur," in Geol. *Fören. Förhandl.*, xvi. p. 614; "The Southern Lowlands," in Geogr. *Tidskr.*, xiv. plate iv.; "Direction of Glacial Striations," in Geogr. *Tidskr.*, x. plate i.; "Marine Terraces and Marine Deposits," in Geogr. *Tidskr.*, xi. plate vi. In addition to the above, several smaller sketch-maps of limited localities.

time I am engaged upon a map of the whole of the island, which will, I trust, be able to appear in a year or two's time, at the expense of the Carlsberg Institute of Copenhagen.

After this long trial of the reader's patience, I will now pass on to a brief description of the physical geography of Iceland. In such a short *résumé* there are of course many matters of interest which I can only touch upon in the most transitory fashion. I cannot venture to do more than state results, referring for fuller particulars to the articles and works cited under the text. I pass over my observations on the flora and fauna,* together with the inquiries I have made about the national life and the means of subsistence. The notes exist for the most part in manuscripts only; I hope to publish them on another occasion. Our knowledge of the vegetation of Iceland has been greatly increased during the last few years through the investigations of the native Icelanders, S. Stefansson and H. Jonsson, pupils of the well-known botanist, Prof. E. Warming, of Copenhagen. Indeed, the study of the geographical distribution of plant-life in the island dependencies of Denmark—Greenland, Iceland, and the Færoes—has in recent years made great advances, in consequence of Prof. Warming's energy and initiative. To him and his many gifted pupils the domain of arctic vegetation is indebted to a very considerable extent.

Iceland, which has an area of 40,450 square miles, may be broadly described as a plateau land, built up of volcanic rocks of both older and newer formation. Compared with the elevated portions of the island, the lowlands are almost a negligible quantity; they embrace only about one-fourteenth of the entire area. Nevertheless, the districts which possess most importance are the lowlands, the coasts, and the dales. With but few exceptions, they alone contain all the inhabitants of the island. All the rest, by reason of its elevation above the sea, and its climatic conditions, is almost entirely uninhabited. Along the outer borders of the plateau grass grows in summer sufficient to graze some sheep. In the interior there are only a very few patches of grass, at wide intervals apart, where a stunted vegetation grows for about two or two and a half months in the year.

The deep, wide bays of Breidifjord and Húnaflói divide the island into two separate plateaus. The isthmus, which connects the two, the north-west peninsula and the main mass of the island, is only 4½ miles across, and rises to an elevation of 750 feet.

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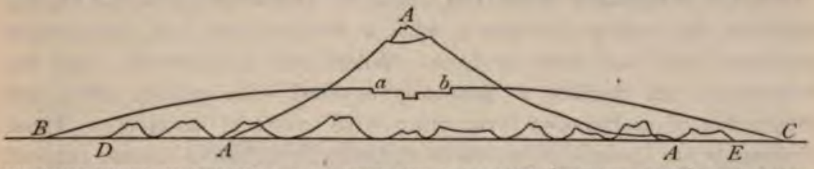
* The phanerogams, mosses, and lichens, which I have collected, are described in several papers by Prof. Chr. Grönlund, in *Botanisk Tidskrift*, and in *Meddelelser fra Naturhistorisk Förening*. (Copenhagen). Dr. Mörch has studied the fresh-water molluscs of my earlier journeys; Dr. H. J. Hansen, the insects I collected on the interior plateau.

Turning our attention first to the smaller or peninsular plateau of the north-west, we may liken its general shape to that of a deeply incised leaf. Deep, narrow fjords penetrate inwards from every direction, but in largest number from the north-west. The area of the peninsula amounts to about 3610 square miles, but the coast-line measures some 1120 miles. The fjords are shut in by dark walls of basalt, which in many places rise perpendicularly, or with a very slight inclination, straight from the sea, to an elevation of 2000 to 2500 feet. The several strata are so disposed as to form a number of steep steps or terraces, mounting up to the verge of the mountains which overtop them, though sometimes they tower upwards like black vertical walls. Their faces are beribboned with torrents, great and small, which tumble down, by waterfalls and cascades, from step to step, till they reach the fjord below. Here the geologist has a splendid opportunity to study the progress and development of the processes of erosion in the many small dales, glens, and clefts, which meet the eye in every direction. If you go up the fjords, and then ascend to the plateau through the glens, you invariably find that glen and fjord form regular constituent parts of the same deep trench cut down through the solid mass of the plateau. Once on the top, you get wide, sweeping horizons, and glens and fjords disappear from sight, or look merely like insignificant crevices. Inland, the prospect consists of a monotonous plateau, strewn with loose fragments of rock, and streaked with immense snow-wreaths. But travelling is difficult, because of the sharp-edged blocks of basalt, the pebbly detritus, and the clay, softened by the thawing of the numerous patches of snow. While the mountain-sides and the bottoms of the glens, close down next the sea, produce grass of tolerable luxuriance, together with heaths and belts of scrub, the only sign of vegetation to be seen on the plateau is an occasional Alpine plant, struggling hard for bare existence in the shelter of the larger boulders. On the highest elevations (2000 to 3000 feet) the snow drifts and consolidates into *firn* pinnacles and domes, *e.g.* Gláma, in the south-west of the peninsula; Drangajökull, in the north-east. The former of these has an area of not less than 90 square miles, but, so far as is known, possesses no glaciers. The latter, which stretches over 135 square miles, sends off seven glaciers, down as many glens, almost to the margin of the sea. On Drangajökull the climate is colder and damper than on Gláma, and the snow-line runs 800 or more feet lower, namely, at the absolute elevation of 1300 feet.

The geological data prove that this north-western peninsula was formerly larger than it is at the present time. It is, in fact, the last surviving fragment of a gigantic plateau which in Tertiary times extended right across to Greenland. This mass of basalt is built up of several faulted or dislocated segments, the faults or dislocations coinciding with the first cleavages of the larger fjords; erosion has done the rest of the work necessary to give the peninsula its existing contour and shape.* There are no lowlands, with the exception of a narrow ribbon of strand, due to the action of the surf when the sea had a permanently higher level than it has now. But it is only on these low, narrow shelves of coast that human settlements are found. Their principal dependence is upon the sea. The people make excellent seamen, and carry on with energy, and on a relatively large scale, fishing for cod, especially in Isafjardardjup. In places where the coast strip widens out a little, and the glens produce more grass, as, for instance, along the north side of Breidifjord, the people find their chief occupation in breeding and keeping sheep. On the other hand, in places where the fjords are short, the sea-cliffs steep, and the coast-belt disappears, as it does at Hornstrandir, to the south of Cape North, the population exist almost exclusively from and upon the catching of wild-fowl.

The other and larger plateau, of which the bulk of Iceland consists, attains its highest elevation, namely 6000 to 6250 feet, towards the south-east, where the vast snowy masses of Vatnajökull cover an area of 3300 square miles. The axis of maximum elevation stretches from the head of Hvammsfjord, in the north-west, to Hornafjord in the south-east. It does not, however, consist of one continuous ridge, but of a chain of snow-covered, dome-shaped mountains, separated by broad stretches of leveller ground; for instance, Langjökull, Arnarfellsjökull, Tungnafellsjökull, Vatnajökull, and others. These ice and snow-clad domes are properly so many smaller plateaus, rising some 2000 to 3000 feet above the general level of the plateau base upon which they stand, and attaining an absolute elevation of 4500 to 6250 feet. All of them are built up of tuff and breccia, and appear to have once formed integral portions of one continuous mass of tuff, which covered the middle of Iceland. The island seems to have assumed the broad contoural features which it at present exhibits long before the Glacial age, in all probability towards the close of the Miocene period.



VOLCANIC TYPES IN ICELAND: A A A, TUF AND LAVA-CONE (VESUVIUS-TYPE); B C, DOME-SHAPED LAVA-CONE, WITH A TERRACED PIT-CRATER A B (KILAUEA TYPE); D E, A ROW OF SMALL CONES (FISSURE-ERUPTIONS).

The average mean elevation of the plateau is 2000 feet. Where it consists of basalt, it sinks at a very steep angle towards the coasts; but in those parts where the principal petrological constituents are tuff and breccia, it falls with a gentler inclination. These two species of rock stretch across the island in a kind of belt; and it is with this belt that the modern volcanoes stand in close association. The Tertiary basalts have throughout a slight inclination from the coasts inwards to the belt of tuff, and are frequently higher next the sea than the plateau mass behind them. The interior plateau is seamed by a number of valleys, more especially towards the north and east. The spaces between the valleys are filled up with long mountain spurs, the skeletal ribs of the plateau, left behind by erosion, ramifying outwards towards the ocean. The largest tracts of level lowlands occur towards the coasts on the south-west and south of the island; although even they are crossed by a sort of promontory ridge, which projects southwards from the main plateau till it reaches the sea, and is surmounted by the vast ice-mass of Mýrdalsjökull.

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* Comp. Th. Thoroddsen, "Nogle Iagttagelser over Surtarbrandens geologiske Forhold i N.V. Island," in *Geolog. Fören. Förhandl.* (Stockholm, 1896), xviii. pp. 114–154.

As already stated, the elevated interior consists for the most part of barren deserts, but the surface varies in character in accordance with the geological constituents and formation of the underlying rocks. Where the substratum consists of basalt, or its coarser crystalline variety dolerite, the surface is strewn with a "stormy sea" of sharp-edged boulders, split and rent by frost. Where tuff and breccia form the foundation, the surface is generally covered with pebbly *débris* and fragments of scoriaceous lava, often with crusts of tachylyte. These fragments are integral elements in the breccia, and have become exposed through the action of weathering and the wind sweeping away the softer rocks in which they were embedded. But more than one-half of the interior plateau is overlain by quite recent formations, such as lava, drift-sand, ancient ground-moraines, and erratic boulders. Vast areas are simply desolate lava-fields, utterly destitute of the smallest vestige of vegetation. In fact, it would hardly be possible to conceive a drearier prospect than the boundless lava-fields in the interior of Iceland. For example, the view from the summits of Odádahraun is the weirdness of desolation itself. As far as the eye can see, the surface of the earth resembles a gigantic stiffened corpse, petrified, black as the night. The only breaks in the grim monotony are a few scattered reddish mounds of slag, brown hills of tuff, and sporadic snow-drifts. Looking southwards, you get glimpses of the glittering snow-fields of Vatnajökull; whilst towards the east the sky is obscured by the yellowish-brown aërial banks of dust, which have risen off the vast expanses of drift-sand that border upon the plateau. Nowhere a vestige of life. An oppressive silence weighs upon the entire landscape.*

Extensive areas in the interior are smothered under drift-sand, which, when the wind is stormy, often raises serious hindrances to the progress of the traveller. You are enveloped in an impenetrable darkness, the horses become unmanageable, sand and gravel are hurled into your face with great violence, and the finer particles of dust search through every pore and opening in your clothes. The drift-sand has various origins. Examined under the microscope, the greater part of it appears to consist of nothing but minute particles of pelagonite, which has been broken off the mountain masses and weathered down through the agency of the atmosphere and the wind. Dense clouds of this fine dust, and of great extent, are frequently carried to distant quarters of the island, and there deposited in the river valleys and on the patches of grassland, thus initiating the formation of a kind of loess, which the Icelanders call *móhella*. In several valleys—for example, Land and Rangárvellir in the south—there are wide stretches covered with yellow-brown deposits of this character, held together by the roots and fibres of plants, and frequently attaining to a considerable thickness.

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* Mr. E. Delmar-Morgan, speaking of the lava-wastes of Askja says, "I have been in many lonely places in my life, the great pine forests of Northern Russia, the immense plains of Central Asia, the watery wastes of the Atlantic, the arid deserts of Persia, but none to equal the desolation and absolute lifelessness of that scene of Askja" (*Proc. Roy. Geog. Soc.*), 1882, p. 143.

DRANGEY, AN ISLAND IN SKAGAFJORD.

A good deal of the drift-sand consists, further, of volcanic ashes of recent date, in some cases mingled with glacial clay and dust, weathered to the consistency of powder. To the south-east of Askja there are immense deposits of drift-sand of a peculiar constitution, namely, crumbled and comminuted liparitic pumice, ejected from Askja during the eruptive outburst of 1875.

The exposed rocks of the interior plateau exhibit plain evidence of the power of the violent storms which sweep across it with such appalling frequency. Not only are marks of wind-abrasion and pyramidal blocks of stone common everywhere, but the general contour-lines of the whole country show conclusive proof of the constant disintegrating action of the wind. Glacial formations are neither so prevalent nor yet so great in mass as might perhaps be expected. The larger part of the constituent materials of the moraines have been transferred into the valleys and fjords. Nevertheless, the *residua* of the ground-moraines of the Glacial epoch are pretty general in the depressions all over the plateau. In many places the erratic blocks lie heaped up by thousands together. In fact, immediately north of Hofsjökull, and in many other districts on the plateau, you could almost imagine that the *jökler* (ice-mountains) of the Glacial epoch had only quite recently melted away.

It would carry me too far to describe, at greater length and in fuller detail, the several minor subdivisions of the plateau. I must therefore content myself with a few disconnected remarks about one or two of the more interesting localities.

On the east side of Iceland, where the basalt predominates, the edge of the plateau drops from an altitude of 2500 to 3500 feet almost vertically to the level of the sea, and is cleft by a great number of fjords and glens. The mountains which lie behind the east fjords are almost separated from the main plateau by the long valleys of Jökuldalur and Fljótsdalshérad, being connected with it only at their southern extremity. Northwards from Vatnajökull the plateau falls away from the altitude of 2500 to 3000 feet at a gentle regular slope right across the island, till it reaches the coast between Langanes and Skjálfandi. Throughout that part it is principally composed of tuff and breccia and other rocks of younger volcanic origin. My geological surveys go to prove that all that portion of Iceland has subsided, there being well-marked lines of faultage going down to the bases of the mountains. At Lake Mývatn the altitude is not more than 1000 feet, and both there (Mývatnssveit) and east of Jökulsá there are several scattered farms lying at altitudes of 1250 to 1600 feet above sea-level. In the district east of Jökulsá, *e.g.* Fjallasveit, the surface consists for the most part of drift-sand. The inhabitants, who subsist principally by the breeding of sheep, feed their animals on the sandwort, or arenaria (*Elymus arenarius*), and dwarf willows (*Salix glauca*), which grow on the sand. These are the only two settled districts upon the plateau; but the extremely inclement climate renders life there anything but enviable. On the west of the stream of Skjálfandafljót the plateau suddenly shoots up again, turning a steep escarpment towards the river, and sending off northwards three broad, lofty spurs between the large fjords which there indent the coast. These ridges are built up of basalt, and in many places next the sea rise considerably higher than the plateau behind them. The highest elevations occur between Œfjord (Eyjafjord) and Skagafjord (*e.g.* Vindheimajökull, 4810 feet), and on them minor glaciers are not at all uncommon.

The mountains on the northern side of Iceland are furrowed by a great number of valleys and glens, all of which appear to owe their origin to erosion. All the same, the beginnings of these Icelandic valleys are, no doubt, of older date than the Glacial epoch. In the south-west of the island I have found that streams of doleritic lava, which themselves show glacial markings, have flowed down into the valleys; so that these must have been formed anterior to the outflows of lava. But I have nowhere found moraine *débris* or glacial striations underneath the ice-marked streams of lava; from all which the conclusion was forced upon me, that the lava was in all probability ejected anterior to the Glacial epoch. The valleys of Iceland are often very deep, being cut far down through the basalt. The *jökler* (ice-mountains) of the plateau, during the Glacial epoch, filled them up with huge moraines, which subsequently melted, leaving masses of gravelly *débris* behind; and this has since been banked up into terraces by the rivers which flow down the valleys. During and after the Glacial epoch, large lakes were dammed up in several of the valleys. Clear evidences of this exist in the Fnjóskadalur on the north side of the island, where, towards the close of the Glacial period, there was a lake 24 miles long and from 250 to 300 feet deep. The elevations of these former glacial lakes are still apparent in the beach-lines marked on many of the valley-sides. The valleys of Iceland offer exceptionally favourable opportunities for studying the forms which basalt assumes in the process of being worn down by erosion. All the various stages of disintegration exist together side by side; there are not only a great number of collateral glens, there are also many deep dells and cauldron holes (*botner*).

The western portion of the plateau, which lies north-west of Langjökull, is considerably lower than the remaining parts, the mean altitude not exceeding 1500 feet. In this quarter there are many lakes, moraine formations, and wide stretches of marsh and moor. South of Langjökull and Arnarfellsjökull the plateau consists exclusively of a barren and desolate country, especially along its eastern margin towards Vatnajökull; there lava and drift-sand reign supreme. The region lying between Tungná and Skaptá is unlike any other part of the plateau, in that it is crossed from south-west to north-east, from Mýrdalsjökull to Vatnajökull, by several parallel mountain chains of tuff, all remarkably torn and ragged in outline. The plateau east of Fljótshverfi is entirely covered by the snow and ice masses of Vatnajökull. The only exceptions are a few promontories of tuff and basalt along the outer borders of this giant among the ice-mountains of Iceland.

On each side of the wide bay of Faxaflói two ridges run out westwards from the plateau, forming the peninsula of Reykjanes on the south of the bay and Snæfellsnes on the north. Of the two Reykjanes is both broader and lower in elevation, and is built up of tuff and breccia, as well as divided by a number of transverse faults, disposed in a south-west to north-east direction, into several step-like minor plateaus, which decrease in altitude from east to west. These fissures have been the "springs" of immense lava-streams, which now overlie the greater part of the peninsula. Of larger volcanoes there are but few; on the other hand, there are several "strings" of craters of no great elevation.[*] The ridge which constitutes the backbone of Snæfellsnes is both higher and steeper, but at the same time narrower, than that which traverses Reykjanes. At the extreme end of the peninsula there is a large ancient volcano, Snæfellsjökull (4710 feet), capped with glaciers. There has been no eruption during historic times, although the surrounding country exhibits abundant evidences of both ancient and modern outflows of lava. Some of the lavas have been scratched by the passage of ice over them, proving that the volcano was active prior to the Glacial epoch. All along the ridge there are craters from which lava has issued and flowed down upon the lower-lying tracts, as well as alkaline and carbonic acid springs.[†]

(To be continued.)

A TRIP ON THE THA-ANNE RIVER, HUDSON BAY.[‡]

By the Rev. J. LOFTHOUSE.

On July 7, 1896, I left Churchill in a small Peterborough canoe, accompanied by two Chipewyan Indians, to explore the "Tha-anne" and Fish rivers, which empty themselves into Hudson bay about 100 miles north of Churchill. These rivers had never before been traversed by white men, and one of them, the Tha-anne, was but little known even to the Indians. The ice had cleared off early from the coast (I have been fast in ice on August 1), and I felt sure we should have no difficulty in reaching the "Tha-anne." The day was beautifully fine, and quite calm; but the mosquitoes were in myriads, and very fierce.

We paddled across Button bay on to North river, when, a fair wind springing up, we hoisted our sail and stood right across the Seal river bight, a terrible place for canoeing around the coast, as the tide runs out so very far, at times leaving one high and dry out of sight of land. We camped that night about 10 miles south of Long point, which we reached early next morning. This point is really a sand-ridge about 100 feet high, and forms the western side of the Churchill bight as Cape Churchill forms the eastern, each point being about 40 miles from the mouth of the river. After rounding the point, we were met by a strong head wind, and obliged to camp down in the inlet, where we were dreadfully tormented by mosquitoes.

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[*] "Vulkanerne paa Reykjanes i Island," in *Geolog. Fören. Forhandl.* (Stockholm), iii. pp. 148–177.

[†] 'Geologiske Iakttagelser paa Snæfellsnes og i Omegen of Faxebugten i Island' (Stockholm, 1891), 98 pp.

[‡] Map, p. 336.

Next day we passed Egg island (just a stony reef a few feet above high-water mark, and where hundreds of eider ducks come to breed, hence its name), and made our way down the inlet towards the Tha-anne. Here we were caught by a severe thunderstorm, and were in danger of being swamped, but were rewarded by the most magnificent rainbow, the like of which I never saw before. There were seven distinct bows, all most clearly defined, and touching the horizon, whilst all within was black as the darkest night. We were obliged to spend the night on a point of land where neither water nor wood was to be found.

Early next morning we pressed on, after replenishing our larder by two fat deer which we shot, and late that evening got to the mouth of the "Tha-anne," where we spent the night. The shore here is very low and flat, and at low water nothing is to be seen but miles of mud flats with large boulders standing up on every hand. A more dangerous place for a boat coming in under a strong breeze could not be met anywhere, and with a gale from sea it would mean certain destruction, for one could not miss the stones. Next morning we got into the main channel, but only at high tide could even a small boat get up it. It is hard to define the mouth of the river, the banks being so low. On a small island we gathered about 300 eider duck's eggs; though rather far gone, my Indians seemed greatly to enjoy them. During the day we made our way up the river, past the Fish river, which empties into the Tha-anne about 10 miles from the coast. Here the banks, composed of sand and gravel, rise some 12 feet. Not a tree was to be seen, and going up the river we saw not the slightest sign of any driftwood, so we had to depend on the moss for boiling our tea-kettle. About 5 miles above the Fish river we came to the first rapid. Here the river is hemmed in between two rocks, about 30 yards apart, and we had to make a portage of some 300 yards. The rocks are sandstone and granite, and just seem to crop out here, running almost due north. For some 3 miles above this rapid there is a good stretch of water, and then we come to a series of heavy rapids, stretching some 10 or 15 miles. Over the greater part of these we had to portage everything. There is a very heavy rush of water, up or down, which even a boat could not pass. The ground here rises to some 50 feet, and is composed of sand-dunes, whilst away from the river seems one vast mossy plain with no sign of wood at all.

At the head of these rapids we came to the first lake, about 12 miles wide. Crossing this in a westerly direction, we found the channel, up which we went against a very strong current, but no rapids. Here we came upon the first signs of trees, small stunted willows; but they were very pleasant to see after the barren country from the coast, and we were glad to get a fire. Next day we made our way mostly up heavy rapids, where the ice was still piled high on the banks, and we had difficulty in getting past some of it.

After another hard day's work in the rapids, we got into the lake district, where the Fish and Tha-anne rivers divide. Here the land rises to the height of some 200 feet, and the country is one network of lakes, with a few stunted pines here and there, but as a rule bare, bleak, and barren as possible. On Sunday, July 19, after working round the north shore of a small lake, and up a short but very rapid river, we came into a long narrow lake about 15 miles east and west. Thence by a narrow channel we passed into "Thao-lintoa," or Pipestone lake. This is fully 20 miles from east to west, and about half that from north to south. After crossing this, we got into the upper Tha-anne, where we found a very swift current, but no rapids. Here the banks are high on both sides, just sand-ridges with no sign of rock. Up this we worked for two days. The north side was all barren land, whilst away to the south were a few stunted pine woods. The river takes a very sudden turn to the east, and a short swift rapid of about a mile took us into Tha-anne lake. This lake is fully 60 miles long, but very narrow in the centre, with bare, bleak hills on the north; but on the west and south-west there seems to be a little timber. The upper end of the lake was packed with ice, and we had to portage across a narrow neck of land to avoid it. We struck away to the north-west, where we hoped to meet with either Indians or Eskimo. We found some old tents, but no signs of life. The country is as bleak and desolate as one could well imagine, with no signs of wood anywhere. A small river here enters the lake, and my Indians said we were within about three days of the Kazan river and Tath-kyed lake.

On July 23 we turned our faces homeward, and in a few hours, with a strong fair wind, crossed the largest reach of the lake. All the ice had drifted away south, and soon we entered the upper Tha-anne river. Down this we ran at a great rate, and in thirteen hours covered what had taken four days in going up. On Saturday, July 25, leaving the Tha-anne river at Sucho-lintoa lake, we crossed by a series of short portages into the Fish river. This is a much better river to navigate than the Tha-anne, and until we got to within 20 miles of the coast we only made one short portage. After that the river divides into two channels, and the water becomes very shallow. We took the northern one, and ran down at a great rate, often with only a few inches of water under our canoe. I quite expected we should come to grief, and was really glad when we entered the Tha-anne, where we had plenty of water. We reached the coast at the mouth of the Tha-anne in just half the time it had taken us to go up, and after a good run along the coast, reached Churchill in safety on our twenty-fifth day out.

The country through which we passed is a very wild and dreary one, and can never be of much use except for hunting. There seems to be hardly any signs of minerals, though the Eskimo and Indians both say there are quantities of "mica" away to the north-east of Thao-lintoa lake. The timber is very scanty, and there seems to be hardly any on the north side of the Tha-anne river. All the rock seems to be granitic sandstone, and crops out here and there, all running down to the coast, where it comes out about 50 miles south of Marble island.

TASMAN'S LIFE AND VOYAGES—REVIEW.*

By EDWARD HEAWOOD, M.A.

In view of the important services to geographical discovery rendered by the great Dutch navigator Tasman, it is at first sight surprising that so long a time should have been allowed to elapse before the publication of a complete critical account of his life and labours. For two centuries after his death the published material was restricted to brief abstracts of the chief events of the voyages, and not until 1854–60 was the journal of the most important voyage—that of 1642–43, which resulted in the discovery of Tasmania and New Zealand—made generally accessible by the version of Jacob Swart in the *Verhandelingen en Berigten betrekkelijk het Zeewesen*, which, however, has since proved in many ways inaccurate. This paucity of published material is explained by the fact that most of the documents by which light could be thrown on the subject remained buried in the Dutch Colonial Archives, which have been systematically examined only within the last half-century. During that time material has been steadily accumulating, thanks to the labours of Dutch scholars; but the results have not hitherto been known as they deserve to be in other countries. Particularly welcome, therefore, is the recent publication, by the well-known firm of F. Muller of Amsterdam, under the editorship of Prof. J. E. Heeres, of a facsimile reproduction of Tasman's original journal, with all its maps and drawings, accompanied by an English translation, and a critical account by the editor of the navigator's life and labours—the whole forming a folio volume of over four hundred pages. Although we believe that other scholars—Mr. Coote in this country, and Prince Roland Bonaparte in France—have been for some time working at the same subject, it is in every way fitting that the first satisfactory account of the great navigator's work should have been prepared by one of his countrymen, who, from his former position as Conservator of Colonial Archives at the Hague, is thoroughly qualified for the task he has undertaken.

As the reproduction of Tasman's journal forms the *raison d'être* of the whole volume, it will be well first to follow the editor in his account of the manuscript, and comparison with other sources of information on the voyages, which forms the eleventh section of his memoir. The manuscript in question is the only original copy, signed by Tasman himself, which is known to exist at the present time. Its history cannot be traced back for any length of time, and Prof. Heeres merely states that it was in 1867 presented to the Hague State Archives by Mr. J. G. Gleichman, who obtained it from the papers left by Mr. F. A. van Hall. He shows reason, however, for regarding it as the identical copy of which the text was printed by Swart, and which was then in the possession of the firm of Hulst van Keulen, with which he was connected. It is, Prof. Heeres thinks, not the original diary, but a narrative prepared under Tasman's direction from the ship's journal, and afterwards signed by him. The numerous sketches of coasts, groups of natives, etc., appear to be by another hand, probably more of an expert in such matters. Of any other original copies which may have existed, there remains now only a single folio leaf, which bears evidence of having belonged to the copy used by Valentijn. There exists, however, in the Hague Archives a draft-journal, probably by a sailor of inferior rank, and of little interest except for purposes of comparison, and as giving one or two additional details. A copy of Tasman's journal in possession of Mr. J. E. Huydecoper van Maarseveen (used by Lauts for his biography of Tasman) appears to be a careless transcript, and thus of inferior value, though, like the last, supplying some additional facts. One more copy is in existence — that in the British Museum, formerly owned by Sir J. Banks—a translation of which was used by Burney. This, according to Prof. Heeres, seems to be a transcript of the copy now reproduced.

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* 'Abel Janszoon Tasman's Journal of his Discovery of Van Diemen's Land and New Zealand in 1642, with Documents relating to his Exploration of Australia in 1644.' Edited by J. E. Heeres. Amsterdam: F. Muller & Co. 1898.

The original matter relating to the 1644 voyage is, as all commentators have lamented, of the most meagre description, and almost the only trustworthy source of information is the map, drawn up after his return under the eye of Tasman himself, and showing the tracks followed in both the Australian voyages, with the soundings taken during the second. A rough copy of this was published by Swart, and, failing access to the original, now in the possession of Prince Roland Bonaparte, the present publishers have been able only to supply a copy based on Swart's, but with corrections founded on contemporary documents. Mr. Coote ('Remarkable Maps of the 15th, 16th, and 17th Centuries,' part ii.) assumed that the original map must have been drawn up by F. J. Visscher, pilot-major in the expeditions, but Prof. Heeres thinks it quite as probably Tasman's own work. The British Museum chart, of which a copy was given by Major ('Early Voyages to Terra Australis'), was not, he considers, copied from the Bonaparte chart, as the discrepancies are too numerous, but probably from a lost chart of Visscher's, used by Tasman in the preparation of his own. After mentioning some of the earliest published maps in which the results of Tasman's voyages were shown, Prof. Heeres vindicates his countrymen from the reproach of leaving to foreigners the promulgation of the new discoveries. Although the colonial authorities were doubtless far from zealous for the publication of new information, that this secretiveness was not very seriously meant is proved, in his opinion, by the public panegyric of the poet Constantijn Huygens, soon after the opening of the new Amsterdam town hall (1655). This poem referred in terms of praise to the hemispheres represented on the floor of that building, in which Tasman's discoveries were set forth.

Some interesting details are also given respecting the earliest published accounts of Tasman's voyages. The first of these, based on the original journal, appeared in the exceedingly rare work of Van Nierop * (1674), whence it was translated into various languages. Prof. Heeres refers to the English version of 1711, but not to the earlier edition published by Dr. Hook in his 'Philosophical Collections' in 1682. Curiously enough, this English version was retranslated into French (although Thévenot had already issued an adaptation in that language), and appeared in one form or another in various French collections. Valentijn's account (used by Dalrymple) and that of Burney have already been alluded to.

Some account must now be given of the other sections of Prof. Heeres' memoir, which summarizes in a useful form all that we know of Tasman and his work, with abundant references to authorities. Some long-standing misconceptions are cleared away, and many details not generally known are given, with various information regarding the Dutch operations and policy in the far East. The erroneous idea, originated though subsequently abandoned by Lauts, that Tasman's birthplace was the town of Hoorn (the sponsor of Cape Horn), has been reproduced in some recent publications. The honour is now known to belong to the village of Lutjegast. New evidence is supplied regarding Tasman's second marriage (in 1632), while a detailed account is given of his early career in the East, of which but little has hitherto been known. It is an interesting fact that the first voyage (1634) in which Tasman took part as commander of a vessel was one of discovery, resulting in the opening of the route north of Ceram, by which the dangers of the more southerly route during the Eastern monsoon were avoided. In 1839, after a visit to Europe, he took part in a more important exploring voyage, being associated with Quast in the search, in the seas east of Japan, for the mysterious islands "Rica de Oro" and "Rica de Plata," supposed to be the richest countries in the world. The origin

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* Misprinted "Van Merop" in Rainaud, 'Le Continent Austral.' This author is often spoken of by English writers as Dirk Rembrantz, the full name being Dirck Rembrantsz Van Nierop.

of the rumours then current respecting these islands is traced by Prof. Heeres, who also gives a fairly full account of the voyage. Quast's journal, discovered in 1842 by von Siebold, has never been published, but in the present work all such passages are printed as refer to the discovery of land or the touching at islands, etc.; while the valuable chart, drawn up under Tasman's supervision, is reproduced, supplying a clear view of the peregrinations of the voyagers through the watery wastes of the north-western Pacific. Although the voyage was, by force of circumstances, barren of important discoveries, it was by no means devoid of practical results, for the observations of the captains—excellent considering the instruments then in use—introduced important corrections into the maps, even in the case of known countries.

Other sections of the memoir deal with Tasman's part in the Dutch trading enterprises in Formosa, Japan, and Camboja, and various missions to Sumatra, Siam, and elsewhere. An important chapter is devoted to a discussion of the knowledge of Australia possessed by the Dutch before 1642, though the author does not attempt to solve the problem of the actual first discovery of that continent. If, he says, to other nations the darkness had been dissipated to any degree worth mentioning, nothing beyond the merest glimmer had reached the Dutch of that time, to whom, therefore, belongs the full credit of opening the way to wider knowledge. He protests against the unsupported statements of Mr. Collingridge, as to the appropriation by the Dutch of the discoveries of others. The review of the voyages previous to 1642 shows clearly the systematic plan adopted by the Dutch authorities, and the aims of the expedition of that year. Prof. Heeres sketches briefly the work performed both by this and the subsequent expedition, giving also some interesting details respecting the pilot-major Visscher already alluded to. With regard to the voyage of 1644, he is able, unfortunately, to add little to the scanty details already available, and it can only be hoped that some fortunate investigator may some day light upon the journal, known once to exist. It is matter for congratulation that such trustworthy material should be at hand on the subject of the former voyage, which after all was far the more important, as showing the way for the first time across the trackless expanse of the Southern Indian ocean.

In conclusion, reference must be made to the interesting chapter by Dr. Van Bemmelen (with map), on the variation of the compass in those regions in Tasman's time. Its interest lies in the fact that the variation was found by that navigator to be *nil* in the longitude of the southern point of Tasmania.

ITINERARY FROM KANTARA TO EL ARÍSH.*

By A. R. GUEST.

FROM *Kantara* to *Juja* (13 miles, small well, bad water); *Bír en-Nisf* (6 miles, permanent well, bad water); *Katia, Bír el-Hajjaj* (9 miles, a stone-built well, water good, watering-trough); *Bír Abu Husun* (6 miles, well); *Bír el-Affein* (6 miles, well); *Bír el-Abd* (5 miles, well, very good water). About 6 miles from Bír el-Abd, the road enters a salt plain called *Seil el-Khaishum*, from a bluff at its west end; the name *Sibakh Bardawil* on some maps was not heard. The effects of mirage were a line of surf running in on a low beach. *Ras Beni Nizal* (12 miles); *Lakhwarat* (14 miles, well, very brackish water); *Saiyat* (2 miles, a small mound); *Bardawil* † (3 miles), the place where the intestines of "Robert the Devil," one of the first crusaders, were buried, when he died on his return from Egypt. There are here certain holes or marks in the ground, and it is the custom

WELL AT KATIA.

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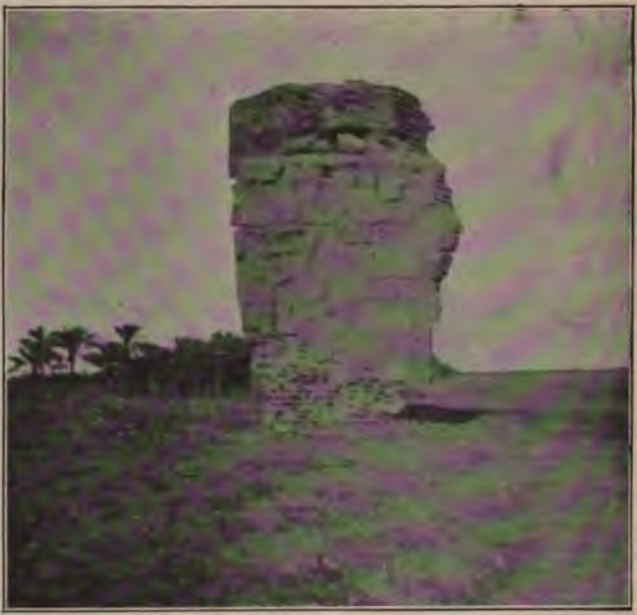
* This is an abstract of an itinerary made during two journeys to El Arísh by Mr. A. R. Guest, of the Ministry of the Interior, Cairo, and Mr. A. McKillop, of the Ministry of Finance; the journeys were made in May and September, 1898. The map is from Jacotin's large French map, the coast from the Admiralty Survey, palm groves, etc., are from the tracing sent by Mr. Guest.

† Bardawil, or "Robert the Devil," is Baldwin II., King of Jerusalem, who died near El Arísh.

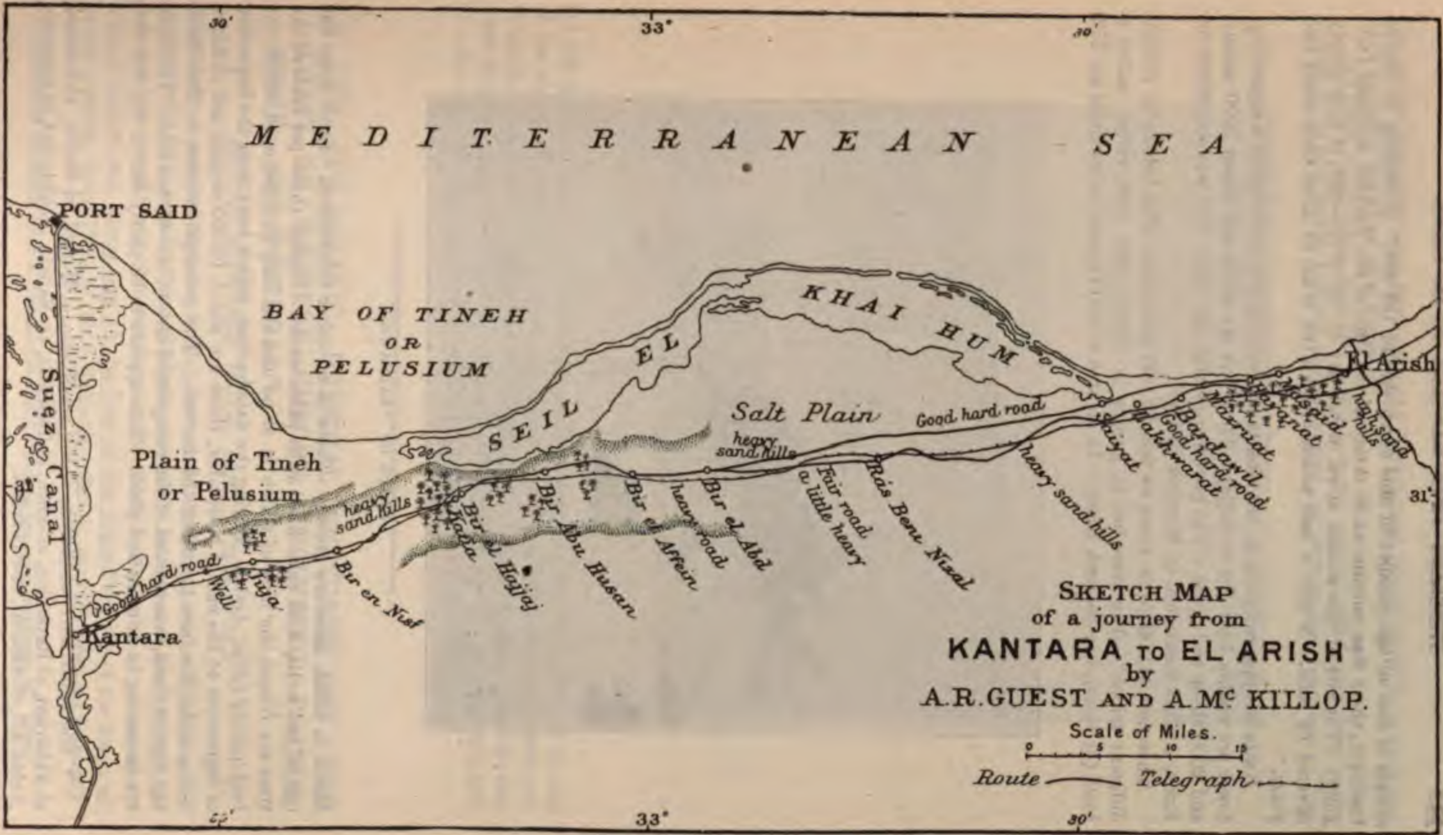
of every one passing to kick the sand out of them. *Mazruat* (2 miles). Between Lakhwarat and Mazruat there are stones at regular intervals (1 or 1½ kilometres) along the road, which are said to be measures of distance. *Hayanat* (3 miles); *Masaid* (2 miles, well of good water from which El Arísh derives its supply; *El Arísh* (4 miles).

The road from Kantara to Juja is good and hard; thence to 5 miles from Katia, it is bad, among heavy sand-dunes, which are apparently moving. The road is fair through Katia to Bir Abu Husum; it then becomes very heavy as far as the salt plain, after which it is good, and in part excellent, to El Arísh. There is a line of telegraph to El Arish. Excepting between Juja and Katia, there is excellent food for camels along the road.

El Arísh lies among sandhills about 1½ mile from the sea. It is 24 miles from the Syro-Egyptian boundary, and 92 miles by the coast to Port Said. The population is about 4000. The houses are flat-roofed, and built to withstand the rain, which is considerable in winter. On rising ground to the west of the town there is a large stone fort, built by Sultan Suleiman (the Magnificent), and within it a black stone covered with hieroglyphs, which is used as a drinking-trough. East (? west on map) of the town is a large palm grove containing 10,000 to 12,000 trees, which extends to the coast; and to the north are large numbers of fig trees, only watered by rain; vegetables are grown, and the water-melons are famous. Landing from the sea is only possible in very fine weather, but it is always practicable in a cove a mile or two to the north. There are several wells of brackish water: good water is obtained from Masaid, about 4 miles to the west. In May nearly all the men, women, and children go to Syria for the harvest. The sand is moving towards the town from the north-east, and it is now within a



SIGNALLING-TOWER (KATIA).



SKETCH MAP
of a journey from
KANTARA TO EL ARISH
by
A. R. GUEST AND A. Mc KILLOP.

couple of feet of the parapet of the north wall of the fort. According to native tradition, there was no sand at El Arísh at the time of the Turkish conquest (A.D. 1520). The site of the ancient town, which lay to the north-west, is now deeply covered by sand. Water is said to come down the Wadi El Arísh once every two years.

Katia is, apparently, on an old site, as the remains of a town and of a signalling-tower are visible near Bír el-Hajjaj. There are six wells, and about 2000 camels, and 2000 sheep and goats. The governor of the old town, who was sometimes an Emir, is often mentioned in Memluk history.

There are 33,000 palm trees, owned by 960 proprietors who belong to sixteen different tribes.* The trees are in groups in valleys, and each valley, called a *haud* (or *hauz*), has its own name. In an area of 2500 square miles there are 252 *hauds* in which dates are grown. There is no other cultivation. Each *haud* has one or two wells, with sides lined with palm leaves. Eighty-three per cent. of the trees are *Hiami*, the fibre of which is of no use, and only two per cent. are of the best quality (*Bint Aisha*). During the date harvest, which lasts from the beginning of September to the end of November, there are about 10,000 women and children living under the trees to collect the harvest. The principal market is Port Said, the next is Gaza, where most of the compressed dates (*'Ajwat*) are sold. The trees are increasing in number and yield. This appears to be partly due to the fact that

GRAVE OF "BARDAWIL."

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* The tribes are: es-Sadaín, el-Bili, el-Mázah, el-Masaíd, el-Hatim, el-Katárna, el-Akhárisat, el-Bayâdiyin, el-Arísh, et-Tameilát, en-Nafiaát, el-Abáyidat, es-Samáana, Aulád Ali, el-Akáibat, es-Sawárikat.

the people know that they have only the Government tax of 2½ P.T. to pay, and have no taxes to pay to local notables.

The trees, when taken from the parent tree, are planted sufficiently deep in the ground to be near water, and are covered about halfway up the branches. They are left thus for four years, and then, on each successive year, a hole is dug at one of the sides and filled with sheep and camel manure. Very few of the trees are irrigated. The people consider the land beneath the trees their own property, and when they sell the trees the land goes with them. They sell by private deed, and in a few cases register the deeds; but as a rule they sell by word of mouth.

EL ARÍSH.

ON THE SUB-OCEANIC PHYSICAL FEATURES OFF THE COAST OF WESTERN EUROPE, INCLUDING FRANCE, SPAIN, AND PORTUGAL.[*]

By Prof. EDWARD HULL, LL.D., F.R.S., F.G.S.

It has been recognized that the British Isles and adjoining parts of the European continent rise from a submarine platform, generally known as "the 100-fathom platform," or "shelf," and that this terminates seawards along a more or less steep slope, or escarpment, descending to the floor of the abyssal regions of the ocean at depths varying from 1200 to 1500 fathoms. But it has not been so generally recognized that the continental platform is traversed by ancient river valleys and cañons, connected with—or inferentially traceable to—the rivers which drain the adjoining lands, and which, deepening their channels, ultimately open out on the floor of the ocean at the foot of the escarpment. These sub-oceanic river channels, if laid dry, would show a very close resemblance to the cañons of Western America, which, it is well known, originate in mountainous regions and traverse extensive tablelands between lofty walls of rock, and open out on the plains at "the base-level of erosion" in each case—a term invented by American geographers.

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[*] Abstract of paper read at the Royal Geographical Society, January 27, 1899.

1. Submerged Physical Features.

Having on a former occasion described the sub-oceanic features off the coasts of the British Isles (*Jour. Victoria Institute*, vol. xxx. p. 305), the author does not propose to reiterate the facts and conclusions there stated, further than to observe that similar physical phenomena are to be discovered by means of soundings all along the continental shores to the south of the British Isles, only more pronounced and conclusive than even in the former region. Throughout this whole region, extending from the shores of Iceland by Rockall, then southwards by the Western Hebrides, the coasts of Scotland, Ireland, and England, round the Bay of Biscay, and southwards along the coast of Portugal to the Straits of Gibraltar, we find the following features:—

A. *British and Continental Platform.*—A gently shelving platform stretching seawards to varying distances from 20 to 200 miles, terminating in a declivity or escarpment at depths (according to distance from land) varying from 100 to 200 fathoms.

B. *The Grand Escarpment.**—A continuous bank or declivity descending from the edge of the platform, of varying steepness, and at its base forming the margin of the abyssal ocean. The slope of the Escarpment varies in places from 5° to 36°.

C. *River Channels and Cañons.*—Numerous submerged river valleys traversing the continental platform, sometimes bounded by precipitous walls of rock over 1000 feet in height, and receiving tributaries on either hand. The cross-sections, drawn to scale from the Admiralty soundings, at intervals of several miles, show these channels to be true river valleys, as they are characterized—(1) by a continuous deepening of the bed of the channel in the direction of the outlet; (2) continuous widening of the channel in the same direction; (3) a winding course, altogether unlike that of faults or fissures of the strata; and (4) lateral branches descending on either hand from the adjoining lands—tributaries of the period. The phenomena are such as characterize river valleys, either those containing running streams, or now dry, as in sub-tropical districts. One additional characteristic, however, still remains to be stated; namely, continuity with the channels of existing rivers, as in the cases of the Adour and the Tagus. While the channels of these two important rivers can be traced almost continuously out into the ocean from the mouths of the existing streams, several others can only be inferentially connected, the intervening part of the channels connecting with the present river having in these cases been filled up by silt, sand, and gravel. The following submerged river channels have been determined by the author by means of the soundings and isobathic contours drawn on the Admiralty charts by the aid of the soundings themselves:—

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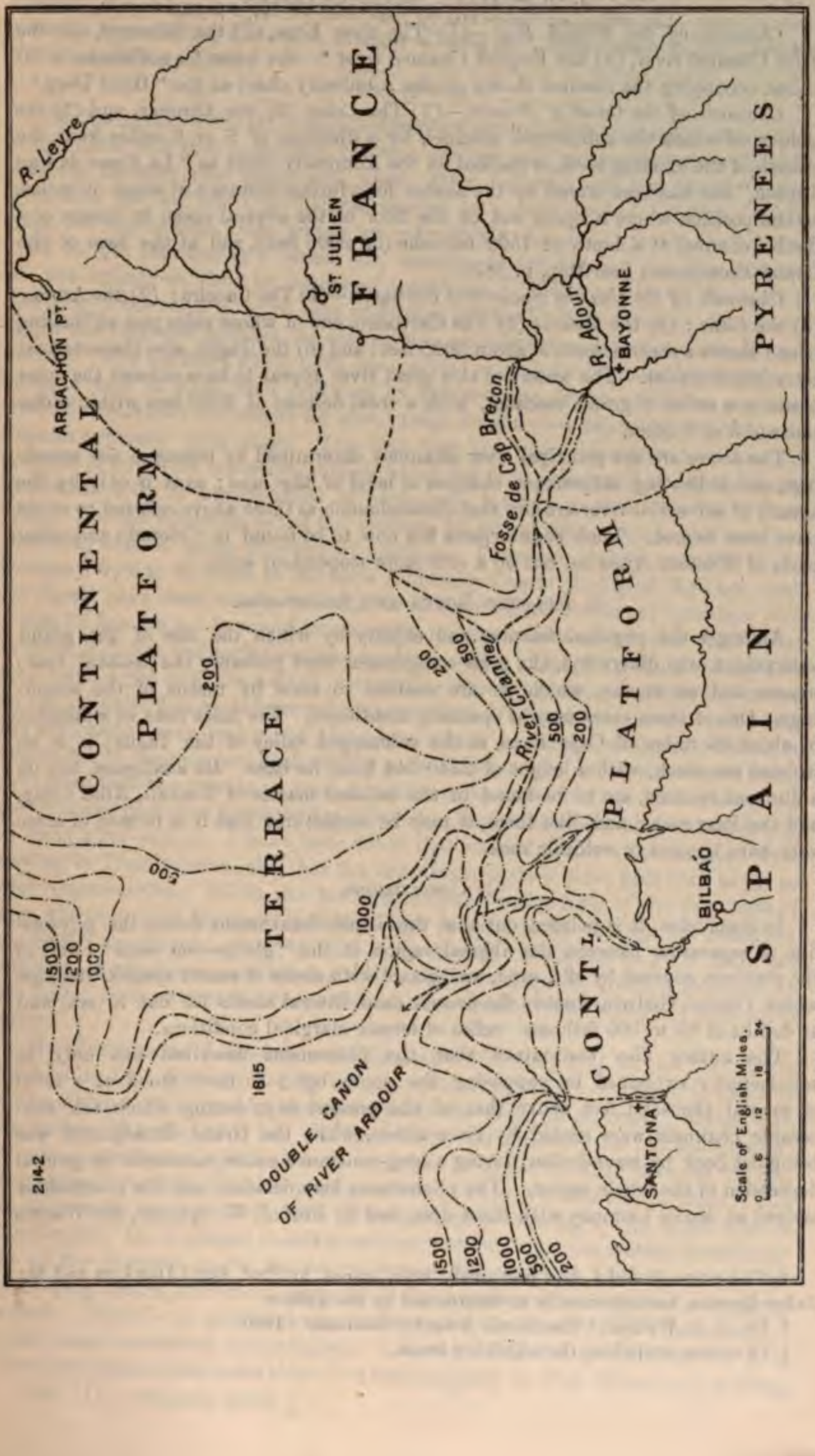
* The word is here used in the popular, not the strictly geological, sense. We are, of course, absolutely ignorant of the structure or composition of the rocks of which the escarpment is formed.



THE RIVER ADOUR, WITH ITS SUB-OCEANIC CHANNEL AND TRIBUTARIES. FIGURES IN FATHOMS.

2. Sub-Oceanic River Channels.

Channels off the British Isles.—(1) The river Erne, (2) the Shannon, (3) the Irish Channel river, (4) the English Channel river *—the latter for a distance of 70 miles, occupying the channel shown on the Admiralty chart as the "Hurd Deep."

Channels off the Coast of France.—(1) The Loire, (2) the Gironde, and (3) the Adour, of which the submerged channel, for a distance of 5 or 6 miles from the mouth of the existing river, is marked on the Admiralty chart as "La Fosse de Cap Breton," but has been traced by the author for a further distance of about 50 miles, to the position where it opens out on the floor of the abyssal ocean by means of a double channel at a depth of 1500 fathoms (or 9000 feet), and at the base of the Grand Escarpment (see Map, p. 287).

Channels off the Coast of Spain and Portugal.—(1) The Caneira; (2) the Arosa; (3) the Lima; (4) the Douro; (5) The Carvoeiro, one of whose sides just off Burling island shows a sheer descent of about 5000 feet; and (6) the Tagus, also characterized by a double outlet. The waters of this great river appear to have entered the outer ocean in a series of grand cascades, with a total descent of 5000 feet within a distance of 6 or 7 miles.

The above are the principal river channels determined by means of the soundings, and indicating stupendous changes of level of the land; as it is only by the agency of sub-aërial river-erosion that channels such as those above referred to could have been formed. Their counterparts are now to be found in Colorado and other parts of Western America, but on a still more stupendous scale.

3. Isolated Rocks and Sea-stacks.

Amongst the physical features and objects by which the line of the grand escarpment was diversified, the most conspicuous were probably the isolated rock-masses and sea-stacks, which we are enabled to trace by means of the soundings. One of these cases may be specially mentioned. The mass rises at a distance of about 36 miles off Cape Razo, in the submerged valley of the Tagus; it is an isolated sea-stack, with a height of 2340 feet from its base. Its analogues, but on a diminutive scale, are to be found in the isolated masses of Rockall, Ailsa Craig, and the Bass rock; and, like them, it may be conjectured that it is formed of some very hard igneous or volcanic rock.

4. Conclusions.

In conclusion, it is pointed out that the Grand Escarpment forms the physical line of separation between the abyssal region of the "globigerina ooze" † and of the platform covered by silt, sand, and gravel with shells of recent species, amongst which Colonel Godwin-Austen discovered dead littoral shells far out to sea, and at depths of 80 to 100 fathoms—relics of former marginal conditions.

The author also maintained that the phenomena described can only be satisfactorily explained by supposing the ocean bed ‡ to have stood at a level of several thousand feet above that of the present day, during which the sub-oceanic channels were eroded by river-action, while the Grand Escarpment was being cut back by marine action, during a long-continued pause, succeeded by general depression of the whole region. The phenomena here detailed and the conclusions arrived at are in harmony with those described by Prof. J. W. Spencer, Mr. Warren

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* These two channels had previously been traced by Prof. Boyd Dawkins and Mr. Jukes-Browne, but not to the extent here traced by the author.

† [illegible] 'The [illegible] Atlantic Soundings,' [illegible]

‡ [illegible] including the [illegible] lands.

Upham, and others on the western side of the Atlantic ocean; and reasons were adduced for believing that these changes of level had taken place in late Tertiary and Post-Tertiary times.

Sir **Archibald Geikie**: I have listened with considerable interest to this paper, which deals with that borderland between geology and geography where the two sciences harmoniously unite, and where their followers are apt to do battle. Prof. Hull has laid before us material enough for a good deal of battling. Apart from his conclusions, from which we may widely dissent, I think the method that he has followed is a sound one, namely, to try to map out the contours of the submarine floor by means of soundings. There can be no doubt that the floor of the sea is a region that undergoes practically little change. Save in its upper and landward portions, the sea exercises a conservative influence on the Earth's surface. The contours which have been carried down by subsidence below the sea-level, or such as have been produced by subterranean forces under the sea, have probably remained unchanged for ages, except for the slow deposit of organic or inorganic sediment upon them. The task does not appear hopeless to restore the features of any wide terrestrial surface which has been submerged under the ocean, and it can only be accomplished by some such method as that followed by Prof. Hull. But the following out of the method, by giving wide scope to the imagination, may lead to great diversity of opinions. I suppose, if three members of the company were to sit down at the same Admiralty Charts that Prof. Hull has used, we should have three totally different views with regard to the configuration with which he has dealt. It would be necessary to use the soundings with the utmost caution, and plot the profile-sections on a true scale. I am not prepared to say how far I could agree with the author in regarding the depressions which he has traced on the Atlantic floor as submerged river-valleys. If we should be convinced that the depressions have really had the origin which he assigns to them, it would be impossible to contemplate such charts as he has brought before us without being convinced that the process of erosion which he invokes must go far back beyond the Pliocene period to which he has referred. We hardly realize the vast antiquity of many river-valleys. I have little doubt that some of the rivers of Scotland were flowing in Tertiary time, and that the excavation of their glens goes back as far as that remote period. While the land has suffered enormously in the long lapse of ages, the portion of the Earth's surface that is covered by the sea has remained practically unaffected. Only by such a method of restoration as Prof. Hull has followed, in which we must be constantly on our guard against giving a loose rein to our fancy, shall we ever be able to find out much about the history of submerged lands.

Mr. **Hudleston**: I can say with Sir Archibald Geikie that we are very much indebted to Prof. Hull for having brought forward a subject of this sort, which is one in which both geography and geology have so much in common. Myself and the author likewise have had an opportunity for renewing an old controversy. The one great feature which we have to realize is what Prof. Hull calls the "grand escarpment," portions of which you perceive on the map of the Bay of Biscay, and which extends on the eastern side of the Atlantic basin up to the north-west of Spitsbergen. He is pleased to call it an "escarpment," and the feature is certainly one of the grandest on the Earth's surface—a feature which has been revealed to us by geographers, and whose origin it is the business of geologists to attempt to explain. There is no proof that this feature is of the nature of an "escarpment" in the sense understood by geologists. I contend that the proper term for it is "the sub-oceanic continental slope"—a name applied by Prof. Milne at a meeting of this Society a year or two ago, when he gave some very interesting details respecting it.

Any one who wishes to understand this sort of controversy should endeavour to realize the difference between the "submarine platform" and the "sub-oceanic continental slope." The submarine platform, generally known with reference to the British Isles as the area within the 100-fathom line, has at one time been an old land surface, and there is no reason to doubt that there have been old river courses, though the actual tracing of such rivers may be open to criticism. An elevation of 600 feet would, in most cases, more than suffice to bring this platform within the reach of meteoric agencies. But there is a vast difference between this platform and the sub-oceanic continental slope which leads down to the great oceanic abyss; the phenomena applicable to the one are not necessarily applicable to the other. Hence I very much doubt whether the phenomena described by Prof. Hull, such as grand cañons, etc., are really due to meteoric agencies; yet it must be admitted that there are some very curious features in the slope, though possibly there may be other interpretations than that of meteoric erosion. It would be interesting to hear what geographers have to say upon this point, and more especially those whose business it is to make charts.

If we accept Prof. Hull's explanation, what does that imply? No less than an elevation of 6000 feet for the whole of the English Channel area. What evidence is there that any portion of this part of Europe was raised 6000 feet during a period so recent as the Pliocene? It would be more reasonable to include the whole of the Tertiary period for the formation of his "grand cañons," though this is greatly open to doubt. Some geologists have been rather too prone to construct maps of the several periods such as they conceive to be true, and they have had no objection to make the crust of the Earth bob up and down just as it suited them. If we were to accept the theory of permanence, within certain limits, of the principal features of the Earth's surface, these amusements would be interfered with very much. In conclusion, I would observe that it is more philosophical to accept the existing phenomena, as we know them on the Earth's surface, for our guide in studying the history of the past, rather than predicate these great movements which possibly had no existence except in the imagination.

Dr. W. T. Blanford: I agree with nearly all Sir Archibald Geikie's and Mr. Hudleston's remarks, but I am not prepared to admit the absolute permanency of oceans. The subject Prof. Hull has brought forward is of very great importance. The whole question depends upon whether the soundings that Prof. Hull has laid before us afford sufficient evidence of what he terms cañons. I wish we could get rid of this Spanish word; there is a good English word, ravine, which means the same thing. In the first place, I think the soundings are rather scattered, and that the deeper parts of the sea are connected together on imperfect evidence. In the case where probably the best evidence is available, that of the English Channel, Prof. Hull has remarked that the Hurd deep appears to be isolated—that is to say, that, although in one place a depression is known to occur, it is not possible to connect that depression with the notch in the continental slope, which is supposed to indicate a gorge cut by a river. As to whether the Hurd deep has been kept open through the greater swiftness of the tidal currents in that part of the channel, I must say that I feel very great doubt, because where the tidal current is strongest, there would be the greatest tendency to movement of the fine sand and silt, especially of that which is dragged along the bottom, and where this takes place I should think the depths would be silted up more rapidly. Then as regards the distribution of the different channels, it is noteworthy, as Prof. Hull has very rightly pointed out, that it is difficult to connect some of them with any stream and they do not appear to be developed in proportion to the importance of the stream. Of that very curious deep channel of the Adour there is clear evidence, yet the Adour is a comparatively trivial stream; in the case of the Loire, a much greater river, the evidence is far weaker. I should like to ask whether Prof. Hull can find any evidence whether the greatest stream of Western Europe, the Rhine, cuts a channel in the continental slope.

It would be a good test of the whole question to examine whether the Rhine, after receiving the Elbe and the drainage of Eastern Great Britain, did cut such a channel. There is a minor point to which I may as well call attention; the stacks or isolated rocks rising from considerable depths. There is one, to which special reference has been made, off the north coast of Spain, but I think that Prof. Hull has misunderstood the evidence in this case. As far as I can find—I have just looked at the chart—it is founded upon a sounding of 250 fathoms. I think Prof. Hull has overlooked the line and dot above the number, signifying that no bottom was found. It is quite possible that some other errors may have arisen from the same cause. I most heartily concur with what has fallen from both Mr. Hudleston and Sir A. Geikie as to the improbability of so enormous a change in relative elevation as would be caused by the raising of the whole of Western Europe 6000 feet in Pleistocene times. And it is at that very same time that we are assured by many geologists that there was a depression of, I think, something over 2000 feet, of which evidence is found on the mountains of Wales. It cannot be supposed that there was both a depression of some 2000 feet and also an elevation of 6000 feet, and it is still more startling if the elevation in Europe is supposed to have been contemporaneous with the elevation of which we are told on the coast of North America, so that the whole area of the globe covered by the North Atlantic ocean and its shores was raised to this extent. If this took place there must have been a corresponding depression in some other part of the world, and surely some evidence of this should be forthcoming. On the other hand, I ought not to conclude without saying that I think there is sufficient *primâ facie* evidence to render it possible that the correct explanation is that which Prof. Hull has put forward, but we ought to have further evidence before we can accept it.

Admiral Sir WILLIAM WHARTON: I have listened with a very great deal of interest to Prof. Hull's paper, but, at the same time, with a feeling of regret that I had not been able to see his former paper on the subject, and to examine the details. As I think Archibald Geikie said, the whole or a great many of Prof. Hull's points depend upon whether there is sufficient evidence or not for the different features he has drawn. I must confess that without having had the advantage of examining the charts, I cannot venture to criticize them in detail. But he mentioned in his abstract that there was a very well-marked channel off the mouth of the Tagus, and I spent ten minutes this afternoon looking at the chart, and I am bound to say that the evidence that is there in the shape of soundings is insufficient to say whether there is a channel or not. I found many, many square miles without a single sounding, and, what is more, I happen to be aware that the soundings off the mouth of the Tagus are particularly suspicious. They were taken at a very early stage, so that I do not think very much reliance can be placed in a channel unless there is more evidence than there is in that case. There can be no doubt whatever—I am not a geologist; I speak as a hydrographer—that we have in various parts of the world now under water, relics of what must have been very well-marked channels. But all those have been well defined. Trouble has been taken and careful soundings made, and we can depend upon the contours; but when the soundings are taken in the middle of the Bay of Biscay by different ships at different times and by different people, and when you think how small the scale of a chart is, and that you cannot trace any more than the broadest features upon it, I think you cannot find anything that can be called evidence of small features, or of such narrow channels as are drawn on the chart.

Mr. VAUGHAN CORNISH said that he had spent an hour and a half before the meeting in examining the soundings along and in the neighbourhood of the blue lines of supposed river courses traced on the charts which Prof. Hull exhibited in illustration of his paper, and he found in those soundings no justification for the river courses shown. Prof. Hull had suggested that the remarkable trough called the Hurd deep really continued further up channel, but was there filled up by a thick deposit of sediments. He (Mr. Cornish) wished to draw attention to the fact that in Delesse's map there was shown here a broad band of rocky bottom stretching across the English Channel. The evidence brought before them that afternoon was wholly insufficient to establish a claim to have traced the sub-oceanic river-channels off the west coasts of the British Isles, France, Spain, and Portugal.

Dr. GREGORY: Prof. Hull's theory has the attractiveness of simplicity, but it involves the very improbable assumption of a 9000-feet elevation off the coast, whereas there is no proof of such elevation on the adjoining shores. This improbability renders necessary a careful consideration of the alternative theories of the formation of these submerged "cañons." There is no doubt that some of these channels are submerged river-channels, but in many cases the explanation is doubtful. Thus Marcel Bertrand has explained the "Hurd deep" as a line of subsidence by folding, and that suggestion must be refuted before we can accept the Hurd deep as a river-channel. Another theory explains these channels as "cañons" of deposition instead of "cañons of erosion." For instance, there is a "cañon" off the mouth of the Congo, which Buchanan attributes to materials brought down by the river being deposited on either side of the mouth. In some cases these "cañons" occur where it is quite impossible that they could have been formed by subsidence; *e.g.* at the eastern end of Lake Geneva, where the Rhone flows into the lake, there is a "cañon" which cannot have been formed by erosion. Are Prof. Hull's channels genuine "cañons," or are they to be explained by the other theories? In the case of the Hurd deep, there is the evidence that it is probably a line of warping. In regard to the "Irish Channel river," there is no single depression such as Prof. Hull's diagram suggests, but a series of elongated banks formed by the action of currents. There is a similar case off the Humber, which is instructive, since, as the tidal current there is at right angles to the course of the river, so is the "cañon." The paper would have been more convincing had it given a monographic treatment of one or two cases, instead of a general survey of a wide field. The existence of some submerged river-channels is probable, but as there are alternative theories explaining the facts, every case has to be judged on its merits.

[As several speakers attached weight to the Adour "cañon," it may be added that there are reasons for regarding that as a line of subsidence, on which movements are still taking place.]

Professor HULL in reply said: I am afraid, if I am to reply to all the speakers, I should have to go over my case again, which I do not intend to do. Sir Archibald Geikie, with his usual caution, which is very admirable for one occupying his position, has given a sort of preliminary acceptance to the views. He has not raised any serious objection against them, except as regards the enormous lapse of time. I must reply, as I did before, that that question of time is one that grows upon one as they become older geologists. When you recollect that the middle Tertiary strata have been raised up during that period to thousands of feet in the

Alps, it shows that the Earth is quite capable of performing such revolutions as I have ventured to suggest. Now, I do not really quarrel with Mr. Hudleston because he prefers calling the descent from the platform into the abyssal region a continental slope rather than an escarpment; but I would like to know how he can possibly tell that the rocks on the margin of that escarpment may not be strata in some places which will answer very well to an escarpment such as that of the Cotteswold hills; and I think, until we have some more knowledge of what this platform is composed of, we need not quarrel about its designation. I am quite as much at liberty to call it an escarpment (using the term in a general sense) as another geologist is to call it a continental slope. Prof. J. W. Spencer has also said, in the *Geological Magazine* for January, that such a slope as that I have described is generally recognized as "an escarpment" in America. It is really a matter of names, and I do not think it is worth while holding any controversy upon it. Then he says, "What evidence is there that Western Europe was raised 6000 feet?" and he calls the idea unphilosophical. That is a matter of opinion. But I will endeavour to give the evidence as concisely as possible. (1) There is a community of fauna and flora between Iceland and North-Western Europe; but in order to effect a land communication between the two countries the bed of the ocean must have been elevated *at least* 550 fathoms (or 2750 feet), probably much more. (2) Certain species of plants in the west of Ireland are evidence to a former land connection with Spain and the south of Europe—as long ago pointed out by Prof. Edward Forbes. (3) The former existence of glaciers in the Atlas mountains and the British Isles, together with a vast extension of those of the Alps, Pyrenees, and Scandinavia. A colder climate would be the direct result of elevation in these regions. (4) The fact as shown by the soundings of the late Captain Spratt, that the Mediterranean region had been partially elevated into land, so as to connect Africa with Europe through Malta and Sicily (*q. J.G.S.* vol. xxiii.), and the general migration of the Pliocene animals into Africa by that means, as shown by Dr. Wallace. Thus we have cumulative evidence in favour of great elevation of the land in addition to that shown by the soundings. Mr. Blanford, for whose views I have the greatest respect, doubts the efficacy of the current in keeping the channel of the Hurd deep open. Well, I need not labour that question again. I know there are others who agree with me; it seems to me that the currents there are so strong as quite to answer the purpose of keeping that channel clear. And then about the Rhine. I hope to undertake the examination of the charts to the east of the British Isles and the Baltic after I have completed this work that I have at present in hand. Well, then Mr. Blanford asked how it is possible that the depression which took place in the glacial period, of not 2000 feet, as he states, but 1200 feet, in North Wales, as evidenced by the existence of beds of gravel with shells—how it could have taken place during the period when, as he supposes, I was holding that it was a period of great elevation. My answer to that is this: that this depression, which I certainly hold took place all over the British Isles during the middle glacial stage, was a different epoch to that of the great elevation shown by these observations. We first had an enormous elevation, and then a depression extending to a depth of 1200 feet at a later epoch. Then Sir William Wharton throws some doubt upon the soundings; but I am not responsible for the soundings. I take the soundings as I find them on the Admiralty Chart, and I presume they are correct. If he thinks they are not correct, then I am afraid the responsibility lies on his shoulders. Mr. Vaughan Cornish's criticism is what I may call destructive criticism. Any one knows how easy it is, in working out a subject of this kind—I don't like to say to pick holes—to find little objections to special points, and it is impossible for me at this moment to verify his statements. I do not pretend that my channels are all absolutely perfect, that they are not incapable of being modified and improved, but I have drawn them to the best of my ability. I think the best way for any person who doubts them is to get the Admiralty Charts, to adopt the plan that I have adopted, and draw the isobathic lines for himself, and then he will have better ground for disputing them. Dr. Gregory's views of improbability have no weight with me at all. Questions of probability or otherwise in natural science subjects are matters which I cannot possibly recognize. As for the Congo and the cañon of deposition, I think that is a very questionable argument indeed. I understand this sub-oceanic channel of the Congo is of enormous depth, and it is quite impossible to admit that it could have been formed by the heaping up of materials on each side. Why should the materials be heaped up on each side? Once a river goes into the ocean, the current very soon ceases, and the waters become subject to the currents which move around it, the tendency of which is to spread the materials and to fill up hollows rather than allow of their being piled up on each side, as described by Dr. Gregory. I think, sir, that is all that is necessary for me to say in reply.

The PRESIDENT: I think the chief point on which Prof. Hull finds disagreement with those who have joined in the discussion, is with regard to the question of geological time, which is not a geographical question at all. But most of the gentlemen who have discussed the paper were agreed that Prof. Hull's method of ascertaining the contours and the shape of the ocean bed by means of the examination of soundings, is a correct one, and any of the points in which he is mistaken were probably consequent on the want of materials. No doubt, if he continues his investigations in some points he will be confirmed, and in others perhaps he will not be confirmed, in his present views. He has merely formed his opinions on the actual material that was before him, on the charts, and he has certainly given us a most interesting paper. I am sure you will all join in a very cordial vote of thanks to Prof. Hull and to those who have joined in the very interesting and important discussion which followed.

FORMER TRADING CENTRES OF THE PERSIAN GULF.

By Captain A. W. STIFFE, R.I.M.

V. KUNG.

THIS is now only a large fishing village, chiefly of mat huts, extending about half a mile along the low sandy shore, and containing perhaps 2000 inhabitants. It stands on the Persian coast about 3½ miles north-eastward of Linga. There is a large date grove and much cultivation at the back of the place. The fishermen, as usual on this coast, are of Arab descent, the cultivators Persian. There is a fair anchorage, sheltered from the prevailing winds, but open to the "saheili," or south-wester, which is of rare occurrence, but occasionally blows with considerable force. The beach is shelving, and landing for boats bad in consequence, except at high water. There are extensive mounds and ruins of the old town of two to three hundred years ago, and remains of large hummums. The walls of the old Portuguese factory, a large white ruined building, still stood at the time of our visit, but in a very tottering condition. It was a commodious square building of several stories. Opposite to it stands a round fort of good masonry, which is surrounded by the sea at high water; it is circular in form, not above 20 yards across, and has several embrasures for guns, and some vaulted casemates or chambers underneath. There is a large excavation near the factory, which, we were informed by the people, had been a dock—a sort of mud dock, I presume. There is little produced here, except a common kind of pottery, there being good pottery clay near.* At one time, it was told us, very superior pottery was made here.

The land slopes gently up from the shore to a height of several hundred feet, and presents, as in so many places in these parts, a geologically recent calcareous crust, largely composed of shelly *débris*, overlying thick beds of clay, which formation leads to very broken ground being formed by the washing away of the clay. This sloping ground ends abruptly in little cliffs a few miles inland, beyond which is an extensive plain of clay, barren, and level. At the back of the rising ground, 5 or 6 miles to north-westward of the place, rises a detached hill, an outlier of the same formation, to a height of 600 feet. It has precipitous sides. There is a narrow difficult path up to the top, which is covered with ruins, and many water-cisterns to catch rain-water—more than a hundred, we are told—of the usual description; they are oblong excavations in the ground, cemented inside, and have arched roofs to prevent evaporation, which have mostly fallen in, and choked the cisterns. They are common all along the coast at the present day. The ruins were mere mounds, and no inscriptions could be found. The path up has been fortified, and walls built along the edge of the cliffs where at all practicable. Nothing seems to be known of its origin. It is now called Kaleh-Lestán.

HISTORY.

Kung is not a place of great antiquity, and it appears to have risen to importance only after the expulsion of the Portuguese from Hormúz, when they established a settlement here, and it appears to have become their headquarters, and a place of some trade.

In 1652, Tavernier † went from Basra to Congo (Kung), where, he says, there is a "Portugais" factor, who receives half the customs; he also mentions that the road from Lar (the capital of the province) to Congo is bad by reason of want of water and craggy, narrow ways.

Between 1693 and 1699, ‡ Dr. Gemelli Carreri travelled from Shiráz to Lar and Congo; he also complains of the horrible roads, passed over the "rude montagne" of Chiampa, which has on the summit the "Karvansera de Serkou" (Sár-i-kuh, *i.e.* summit of mountain), two miles from which they sighted the Persian gulf and Bander Congo descent, environed by precipices into the plain, where were several small hills of different colours. At Congo, Joseph Pereira d'Azevedo was superintendent of the royal Portuguese agency; they lodged at the convent of the Augustins. The Portuguese received an annual tribute of five horses and 1100 tománs (about £500), by a convention made after the Persians had taken Ormus, because the Portuguese troubled with their vessels the navigation of the whole gulf, which lessened the customs (of Persia); and, besides, they had the great privilege of having a house, hoisting their flag, and jurisdiction over all Christians landing. At first they received half the customs, but, owing to disputes, it was compounded for the above annual payment. The narrative says the superintendent gives passes to Mohammedans for safe navigation of the Indian seas, and sells the prizes taken by Portuguese vessels. Bander Congo, which is open to the sea, is in lat. 27° (really 26° 35'). "Nearly all the houses are of mud; only some near the sea are of stone. It is a dependence of Lar, under a deroga and chabander (shahbandar, customs officer). It is a country of great trade, vessels continually arriving from India, Basra, Arabia Felix, and other places, besides caravans without number. The chief trade is in pearls, fished up in the isle of Baharen and all the gulf; they are bought cheap, wholesale from the fishers,* and sold dear in retail." He then describes the little copper sieves, still used, for sorting the different sizes, and the separation of the round and white from the misshapen and stained or of less clear water; also the skilful boring by the Arabs, "so that one can scarcely see the hole;" also he refers to the method of bargaining with the hands under a cloth, which is still practised. He mentions the unhealthiness and great heat, "so that even the birds hide themselves in the trees;" the people go nearly naked, the rich clothed with "very fine stuff." He mentions the wind-towers on the houses, and says Bander Abassi is still hotter; and also describes the guinea-worm absolutely exactly, with the practice of winding it slowly out of the flesh. "The roadstead is defended by a fort, 30 'palms' square, and armed with four iron cannon, made by order of D. Constantine de Norogna" † (Noronha?) when he was viceroy for the King of Spain. Water was only obtainable from cisterns, as at the present day, on this coast.

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* We were told a curious story about this pottery, which is not incredible in that country. The artisan who improved the manufacture was doing well for himself and getting known, when an order came down from Teheran to the local governor, that he was to be sent up to the capital, where he was appointed to be maker of china to the Shah. The man feared that if he went to Teheran he would have to make pottery for every one connected with the court, and never receive any pay, so he took all the money he had made to the governor, and implored him to report that the man who made the good pottery was gone, no one knew where. After which he never made any more good pottery.

† 'Collection of Travels of Tavernier,' etc. London, 1684.

‡ 'Voyage autour du monde,' Traduit de l'Italien de Gemelli Carreri. Paris, 1727.

He saw vessels of the Portuguese, of sixty and seventy guns, lying off Congo, and says, "I know only the English and Dutch go to Gomroon (Bandar Abbas); all other nations traffic at Congo, on account of the security given by the power and maritime force of the Portuguese. There are about 10,000 inhabitants—Moors, Indians, Arabs, Jews, and Armenians, who have fine shops." He gives a good description of the pearl fishery, and the submarine springs at Bahrein.

He also describes the "ship"-building, and says, "Instead of nails, which they are without, they use 'chevilles' (pegs) of bamboo or cane, and further join the planks with 'ficelles' (strings) made of rushes (probably coir or coconut fibre). For anchor, they have a large stone with a hole, and for oars, a stout stick with a little round plank attached to the end." All this is unchanged at the present day for the coasting boats. He attended mass and visited the bazar, being astonished at the men "who put burning coal in their mouths like cherries, by the aid of the demon," so he was told. During the Diváli (the great Hindu holiday), the "Banianes" (the Hindu merchants) had a "Nautch," which he describes at length, and "which pleased him so much that he wanted to see them again and again." He also visited Kalah Lestán (see *ante*). He sailed for India in a "Moorish" ship, as the Portuguese were at war with the Maskat Arabs, and had a long passage, being driven back from Pasni (on the Makrán coast) to near Jashk, "owing to the incredible ignorance of the pilot, who was sailing by chance, never having had any other business than tobacco-seller." The captain had recourse to our traveller, who seems to have taken charge, and "on the 16th we found ourselves at the same place as eleven days before—delay to which those are exposed who embark in Moorish vessels" (he philosophically remarks).

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* This is now chiefly done at Linga, a large town, the successor of Kung, nearly 4 miles to the south-westward.

† From Danvers' book, 'The Portuguese in India,' it appears Constantin de Noronha was Captain-General of Ceylon in 1629. Don Miguel de Noronha was viceroy 1629 to 1635.

As to the date of the occupation of Kung, the Chevalier Chardin,[*] between 1671 and 1677, visited "Congue." He says that in 1625 the Portuguese surrendered Bahrein to Persia, and other small islands, "on contract to get half the customs of Congue." He says they got tribute from even the smallest boats, and permitted no trade with India except in their own ships. After the fall of Hormuz (1622), the Portuguese retired to Maskat, and then followed the treaty about Kung. They gave passports to native ships under very stringent conditions and limitations. M. de Thevenot[†] visited Kung in 1665. He left Basra in the ship of an Armenian of 260 tons, 18 guns, and 31 seamen—the captain, gunner, and two sailors being the only "Franks." She was furnished with three passports, Portuguese, English, and Dutch. "The captain was a good sailor, but knew not how to set off a course, nor take an observation, nor read or write." The quarrels of the ignorant skipper with the Arab pilot are given at length, and "indeed, it was commonly the Shiraz wine or Congo brandy that raised all this huff and din." He says, "Congo has a little castle defended by three pieces of cannon." Sulphur was exported. Water had to be brought from a distance. "The custom-house receives a great deal of money, especially within these last two years, on account of the extortions of the governor of Bender Abbassi. One-half the profits belongs to the King of Portugal, who, after the loss of Ormus, still so infested the King of Persia by his ships, that continually kept cruising along that coast, that Persia was constrained to make peace with him upon conditions. The King of Portugal keeps an agent there, who flies the Portuguese flag. The Dutch used to send a factor to buy pearls there from Bahrein." He stayed sixteen days at Kung.

His description of dealing with water-spouts seems worth quoting. "Besides the devotions of the Holy Gospel, the human remedies which seamen use against water-spouts is to furl all the sails, and to fire some guns with shot against the pipe of the spout. If that succeed not"—he describes a curious superstition of "cutting it with a black-handled knife, without which they never go on board for that reason." This latter is probably from hearsay.

I have not been able to trace an account of the date of the abandonment of Kung, or of the reasons for it. Captain Hamilton,[‡] 1688–1723, says the Portuguese *lately* had a factory at Kong.

THE GERMAN DEEP-SEA EXPEDITION.[§]

FURTHER news of the voyage of scientific investigation in the *Valdivia* has reached us in a letter from Prof. Chun, the leader of the expedition, to Sir John Murray, dated January 20, 1899. The voyage down the Atlantic to the edge of the antarctic ice, and thence through the Indian ocean, has been most successful, the soundings alone serving to fill an important gap on the charts, and showing that the average depth of the Southern ocean must be considerably greater than has been supposed. Sir John Murray considers that the success of the German investigators in attaining so high a southerly latitude in a vessel not protected for ice-navigation is very remarkable, and that it augurs well for the prospects of a scientific antarctic expedition. Prof. Chun's letter is as follows:—

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[*] 'Voyages du Ch. Chardin en Perse,' etc. 2 vols. 4to. 1735.

[†] 'The Travels of M. de Thevenot,' etc. London, 1687. Newly done out of French.

[‡] New Account of the East Indies, etc., 1727.

[§] Chart, p. 336.

"In sending you the accompanying sketch of our route, I need only remark that we penetrated much further into the antarctic regions than we originally considered possible. We were only 100 nautical miles distant from Enderby Land, and in that position dredged in 4647 metres (2541 fathoms), bringing up a great number of stones which are not of volcanic origin.

BOUVET ISLAND

"I caused our course to be directed towards Bouvet island after leaving the Cape, and we were happy to be able to find this island, which has so often been sought for in vain. It was no small achievement for Captain Krech to accomplish this, impeded as he was by storms and dense clouds, and surrounded by icebergs. Bouvet island lies in lat. 54° 26′ S. and long. 3° 24′ E.* This island is entirely buried in glacier-ice, and is steep and inaccessible. It appears to consist of a volcanic cone, with a broad crater-edge; we found basalt and tuff in the dredge.

"From Bouvet island we sailed along the edge of the ice-pack for 50° of longitude, with mostly calm weather. I was particularly surprised by the immense depth of the sea; many of the soundings exceeded 3000 fathoms. The sea is, at any rate, much deeper than has been hitherto supposed. From Enderby Land as far as Kerguelen we encountered heavy storms; finer weather commenced at St. Paul.

"I hope soon to be able to send you a full report dealing specially with the serial temperature observations and the chemical analyses which have been made. We have to regret the loss of our surgeon, Dr. Bachmann, who died in the Indian ocean; otherwise all the members of the expedition are well, and join with Captain Krech in heartiest greetings."

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* This longitude is occupied on the Admiralty charts by Lindsay island, but it appears doubtful whether Bouvet, Lindsay, and Thompson islands, shown near each other in the chart, all exist.—Ed. *G. J.*

THE MONTHLY RECORD.

EUROPE.

The Etymology of London.—In last year's volume of the *Tour du Monde* (*A travers le Monde*, p. 307) M. E. Maison calls attention to a suggested explanation of the origin of the name London, given in 1864 in a pamphlet by M. Féret, printed at Dieppe. The suggestion was based on the statement of Cæsar, that the maritime parts of Britain were peopled by invaders from Belgium, who gave to their settlements the names of their native places; and on the existence in the Dieppe district of the three townships, Lime, Douvrend, Londinières, the similarity of whose names to the three chief places reached by invaders of England is certainly striking. Against this idea, however, must be set the peculiar applicability of the name London, derived from Celtic words signifying "pool-fort," or fort over the lagoons, to the site of the place at the time of the Roman invasion.

The Physical Features of the North German Plain.—There is perhaps no part of Europe, to the physical features of which so much attention has of late been paid, from the point of view of their origin, as the North German plain. Since the general acceptance of the idea that the present surface features are due to the former existence of a vast ice-sheet over the country, many points have been explained which before were quite enigmatical. Two papers have lately appeared in which the present physical geography is explained by reference to the past—the one by Dr. K. Keilhack (*Geographische Zeitschrift*, vol. iv. part 9), dealing with the surface features in general; the other by P. Herden (*Deutsche Rundschau*, vol. xxi. part 2), treating only of the river systems. Dr. Keilhack explains that as there seem to have been three distinct ice-ages, the second of which saw the furthest advance of the ice-sheet, the effects of the first cannot be expected to be still visible, nor those of the second, except where its ice-sheet advanced beyond that of the third, viz. on the southern margin of the district, and to the west of the Elbe. Beginning with the deposits due to the ice-sheet, he distinguishes between moraines and material laid down by the glacial streams. The first division of the former—ground-moraines—take various forms, from nearly level plains to drumlins and irregularly undulating country, with no level spaces, such as the Baltic lake plateau. The second division—end-moraines—are most prominent along the southern margin of the Baltic ridge, where they form a remarkable and unbroken rampart. Of forms due to the ice-water, we have first the ridges and furrows formed beneath the ice-sheet, often in a direction at right angles to its margin; to this class belong the regular lines of hillocks and ridges known as "Åsar." The effect of the glacial streams outside the ice-sheet is of course greatest in the neighbourhood of the end-moraines, deposited where the ice remained a long time stationary, or oscillated within narrow limits. Here they cover vast areas with gravelly or sandy deposits, the equivalents of the "Sandr" of Iceland. In discussing the deposits formed at a distance from the ice-sheet, Dr. Keilhack enters into the question of the ancient drainage system of Northern Germany, thus covering the same ground as Herr Herden, but keeping in view rather the forms of surface resulting from the action of the streams than the development of their present courses. He differs from the latter writer in considering that the great longitudinal valleys which traversed Germany from west to east, or from south-west to north-east, existed in their broad outlines before the ice-age, being deepened by the advancing ice, according to a well-recognized law, and afterwards utilized by the ice-stream. Herr Herden, on the other hand, lays down that they are post-glacial, due to the vast streams of glacial water which found their way to the North sea along the margin of the ice at its various stages of retreat. Both writers give, broadly speaking, the same account of their courses, which coincided with the westward-flowing sections of the modern rivers, the main outlets being first along the line of the Aller and lower Weser, and afterwards along that of the lower Elbe. The paper in the *Rundschau* is accompanied by a map showing the supposed courses of these great glacial streams. Dr. Keilhack supposes that at each successive stage the country east of the Oder was largely occupied by dammed-back water, and that as the ice retreated this water found an outlet at successively lower levels. In this way he accounts for various series of terraces at different altitudes, some laid down in the lakes, others in the valleys of tributary streams. West of the Oder, where the lakes are supposed absent, we see instead broad sand-covered valleys, the minor relief of which is due to post-glacial erosion. Dr. Keilhack describes fully the various classes of lakes met with, defining seven according to their mode of origin, and concludes by discussing briefly the effects of erosion both by glacial and post-glacial streams, by the sea, and by the wind. It should be mentioned that Herr Herden ascribes the north and south sections of the modern rivers to the erosion of sub-glacial streams, the channels being utilized and deepened by the main currents after the retreat of the ice.

The Lakes of the Black Forest.—Dr. Halbfass has continued his limnological studies in Germany, by a survey of the lakes of the Black Forest, the results of which he has given in the eleventh number of *Petermanns Mitteilungen* for last year. Almost all the lakes lie in the highest parts of the district, the two most important groups being those in the neighbourhood of the Hornisgrinde in the north, and of the Feldberg in the south. The latter group contains the two largest lakes, Titi and Schluch, with lengths of between 1 and 2 miles, all the rest being merely small tarns. Of the Hornisgrinde group the most important is the Mummelsee, which likewise lies at the greatest altitude (3385 feet), and stands first both as regards maximum and mean depth (56 and 24 feet). It is fed by springs only, while the rest of the group are supplied by streams. Its water is coloured brown by humus, but is very clear and transparent. As regards the origin of the Hornisgrinde lakes, Dr. Halbfass says that the old idea that they are due to landslips has now been given up, there being nothing in the configuration of the ground or in the nature of the rocks (horizontally bedded sandstone) to suggest such an explanation. Like the other mountain lakes of North Central Europe, with which they present many analogies, the lakes of the Black Forest must be regarded as the outcome of the glacial epoch, a special point in favour of this view, in the case of the Hornisgrinde group, being the fact that they all lie on the eastern flank of the main ridge, the gentler slope of which is more favourable to the formation of glaciers. Dr. Halbfass does not attach much weight to the prevalence of westward-blowing winds. The chief evidence of glacial action lies in the cirque-like basins in which the lakes (themselves circular) lie, and which also occur again and again where there are now no lakes; and in the moraine-like nature of the dam which holds back the waters. This latter is best seen in the case of the Mummelsee and others which have no influent streams. The fact of the gradual decrease in depth in the direction of the dam would be accounted for by the action of the glacier in pushing forward and heaping up the smaller *débris* of the ground-moraine, while the varying altitude of the lakes (the lowest is at 2585 feet) would imply a gradual retreat of the glaciers. Of the two largest lakes already mentioned Dr. Halbfass gives more detailed information. The Titisee, the largest of all, though not the longest, is remarkably regular in its contour, its sides sinking gradually and evenly to its deepest part, which (at the present day, though not formerly) is nearly central. It thus has a very gradual angle of slope (only 6½°), and no extensive level floor. Contrary to the general rule, its higher eastern shore has a more gradual slope than the western. Of the glacial origin there can hardly be a doubt, as the most important glacial deposits of the whole Black Forest occur in its neighbourhood. The Titisee receives the outlet of the Feldsee, a small but deep tarn (105 feet), which alone of the lakes of the Black forest presents the appearance of a true high-level mountain lake. The Schluchsee, the longest of the lakes, has a much less regular floor than the Titisee. The deepest basin lies in the broader upper half, but Dr. Halbfass's soundings have revealed the presence of a second basin, divided from the first by a slight ridge, in the lower half. In the deeper basin the under-water slope is again steeper on the side of the lower eastern shore. The longitudinal section shows the gradual shallowing in the direction of the moraine at the lower end, which has plainly diverted the outlet from its natural south-east direction to a southerly one. Dr. Halbfass gives maps and sections of most of the lakes, the latter possessing the advantage of an identical horizontal and vertical scale. The maps would have been improved by the addition of the contours of the shores of the lakes above water-level.

Austrian Explorations in the Balkan Peninsula.—During last autumn, Dr. Karl Östreich carried out, on behalf of the Vienna Geographical Society, a journey of exploration between Üsküb (Skoplje), on the upper Vardar, and Sjenica, in the Sanjak of Novibazar, a stretch of country which, joining on the west that lately explored by Dr. Hassert, had for the most part been never previously traversed by a scientific traveller. Although the route lay through places of the worst repute in Albania, Dr. Östreich was able to carry out his programme to the letter, and has returned with a rich harvest of topographical, geological, and ethnological observations. From Üsküb (950 feet) an ascent was made of the north-east buttress of the Šar Planina, the Ljubotrn, and its height determined as 8000 feet. The journey was then continued in a generally north-north-west direction, past Kalkandele (1400 feet), and across the Šar Planina; the second highest peak of the range—the Kobilica, north-north-west of Kalkandele—being ascended, and found to have a height of 6000 feet. The ridge between this summit and the Ljubotrn runs with a smooth outline at an average height of 6500 feet. It is a remarkable fact that this main north-easterly section of the range is not designated by the inhabitants of the district by any general name, and only the portion west of the line joining Kalkandele with Prizren is known as Šar Planina. Near Prizren (1700 feet), on the northern base of the Šar group, the small lake of Bresna was discovered, which is apparently the remnant of a larger tertiary basin. Djakova (2900 feet) was next reached, in part through the precipitous gorge of the Drim (such, not Drin, is the correct spelling). There great disorder reigned, by reason of the bloody feud which the year before had broken out between two of the most important families of the place, and which had laid half the town in ruins. The bazaar had been closed for fully six months, the greatest calamity which can befall an Eastern town. The Turkish authorities had, however, finally succeeded in restoring peace, by bestowing posts of honour on the leaders of the rival factions, and so separating them and removing them from the district. The broad high plain which abuts on the south-east base of the North Albanian Alps, between Djakova and Ipek, with an altitude of 1500 to 1800 feet above the sea, is fertile and carefully cultivated in the neighbourhood of the villages, which presented a clean appearance, but in which each house is a miniature fortress. Ipek (1800 feet) lies at the mouth of a narrow ravine. On ascending to the heights of the North Albanian Alps, the landscape reminded the traveller of the limestone Alps of Upper Swabia. The pass north of Ipek has a height of 5600 feet, and the mountains in the vicinity, of about 7000. Hence Dr.

Östreich descended toRažaj, on the upper Ibar, still at an elevation of 3300 feet, and proceeded almost due north to Sjenica (3500 feet), across the district of the "Peštera," which has hitherto remained almost entirely unknown. Sjenica had been supposed to lie at a greater elevation. The Peštera forms two terraces, respectively about 4600 and 5300 feet high, with "karst"-like surface and subterranean streams in places. Dr. Östreich finally explored the district between Sjenica and Mitrovica, travelling by way of Novibazar and making excursions in various directions.

ASIA.

The Danish Expedition to the Pamirs.—Lieut. Olufsen has communicated to the Paris Geographical Society some details respecting his work in the Pamirs during last summer (*Comptes Rendus*, 1898, p. 458). In August and September surveys were made of Yeshil-kul and other lakes in its vicinity. A point on the north shore of Yeshil-kul, near the mouth of the Marchenai, was fixed astronomically as in 30° 47′ 50″·9 N., 72° 51′ 33″ E., or about 5 miles west of its position in the Society's map. Soundings of the lake gave a maximum depth of 130 feet, the bottom being composed of granite and decomposed clay-slate. A number of sulphureous springs were discovered near the lake, their temperature varying from 67° to 168° Fahr. The small lake Bulun-kul is nowhere deeper than 7 feet, and its bottom is covered with aquatic plants; it seems to have once formed a continuous sheet of water with Yeshil-kul. Hence the expedition proceeded to Wakhan and Ishkashem, discovering many ruined fortresses of the Siah-posh Kafirs. One of these, placed at a height of 2000 feet above the Panj, measures over 7 miles in the circuit of its walls and towers. Lieut. Olufsen had made an excursion among the mountains to the south-west, and had come upon eight villages, whose inhabitants lived in complete isolation. Some geyser-like fountains of sulphureous water were seen, of heights varying from 40 to 100 feet, and the country round is compared to the Yellowstone park. The expedition had taken up its winter quarters at Shorok, at the junction of the Gund with the Panj. Up to November 5 no snow had fallen in the valley, and the temperature ranged at the time from 19° to 46° Fahr.

French Railway Projects in Indo-China.—Now that the French authorities in Indo-China have seriously taken in hand the question of improving the means of communication in that territory by the construction of railways, there is no lack of articles in French papers on the various projects which have been put forward for the carrying out of the undertaking. A concise summary of the measures proposed for the immediate future is given by M. Servigny in the January number of the *Revue Française*. With the exception of a short line in Cochin-China and another in Tonkin, French Indo-China at present possesses no railways, but the welcome event of a surplus in the budget during the past two years, in place of the customary deficit, has enabled the governor-general to obtain a loan of 200,000,000 francs (£8,000,000) with which to commence operations. To completely meet the needs of the territory, the programme would have to include a line along the coast for the whole distance from Saigon to Hanoi, with various transverse lines, including a prolongation to Yunnan; but, as a beginning, a more moderate aim must be kept in view. The lines to be undertaken first are as follows: (1) from Haiphong to Hanoi and the Chinese frontier at Laokai (250 miles); (2) from Hanoi southwards along the coast to Vinh (200 miles); (3) from Turan along the coast to Hue and Kwang-tai, a little north of that town (120 miles); (4) from Saigon north-east to Khan-hoa, with a branch inland to Lan-biang (400 miles); (5) Mytho, in the Mekong delta, to Kantho (61 miles). The total expense of these lines is reckoned at 196,000,000 francs. M. Servigny briefly explains the benefits which will be derived from each of these lines, such as the connection of Hue with its natural port, Turan, and with the starting-point of the road under construction towards the Mekong; the provision of easy access from Saigon to a sanatorium in the hills, and so on. The coast lines will be advance sections of the future trunk line from end to end of the country, while in time a line may be made from the coast to the Mekong at Kemarat. In addition to the above lines, the prolongation of the Laokai line to Yunnan, for which the French have obtained a concession from the Chinese Government, will be carried out under a guarantee on the part of the French Government for seventy-five years.

AFRICA.

Survey of the West Shore of Lake Rudolf.—Captain Austin, second in command of the Macdonald expedition in East Africa, writes from Save (Mount Elgon), under date November 18 last, giving some account of his surveys in the country to the north as far as the lower Omo river. His route lay down the course of the Turquel and along the west shore of Lake Rudolf to its most northern point. This he considers to lie further north than it has hitherto been placed, probably almost up to the 5th degree of north latitude, and as he succeeded in getting north and south stars for latitude nearly every night, his observations should be dependable. The western shores are broken by numerous small lagoons, separated from the open water by low sand-bars. Many evidences of a westward encroachment of the lake were noticed, such as palm-trees surrounded by water and partially submerged. At one point they extended 2 or 3 miles into the lake. The Turquel, though it has a good flow in its upper reaches, probably never reaches the lake, but is absorbed by the sandy soil. Some 5 miles from the lake, its bed is often half a mile wide, with densely-wooded banks. Water is obtained from wells in its bed, and a few patches of alluvial soil on its banks are cultivated by the Turkana. The country round is excessively arid, and incapable of producing anything. The river at the head of the lake, called by the natives Murtoni, is the finest stream in this part of Africa, except the Nile, and is probably the only perennial feeder of the lake. The name Basso Norok, applied to the latter, appears to be an invention of the Swahili, its native name being Nanam. The water is unpleasant to the taste, but abounds in fish, crocodiles, and hippopotami, while the lagoons are much frequented by water-birds. We hope soon to publish a map embodying the work of Captain Austin and the other members of Major Macdonald's expedition.

Captain Wellby's Journey in North-East Africa.—Writing from Addis Abeba on December 16th, Captain Wellby announces his intended start, in three days' time, for the south. His plan is to proceed by Zakwala hill to Lake Zuai and the lake south of it, and to strike the Omo in 7° N., following it down to Lake Rudolf. His party consists of forty men—Abyssinians, Gallas, Somalis, and Sudanese,—with fifty baggage animals. He hopes to carry on plane-table work throughout, on the scale of 4 miles to the inch, and also to take latitudes, heights, and other observations. The party was provided with supplies, calculated to last three or four months without replenishment, and had with it a canvas boat for crossing rivers. From Lake Rudolf, as already announced, Captain Wellby hopes to strike the headwaters of the Sobat, but his plans are not yet definite. He speaks in glowing terms of the agricultural wealth of Abyssinia, and says that the people are far better than he had anticipated.

Journey East of the Upper Congo.—One by one the last unexplored districts are disappearing from the map of Africa. One of the most out-of-the-way of these, the forest-clad region between the Manyema country and Count von Götzen's route, was last year traversed by a Belgian military expedition from the upper Congo, under Lieut. Glorie, sent in pursuit of the revolted Batetelas. A short account of the journey, accompanied by a sketch-map, is given in the sixth number of the *Mouvement Géographique*, and gives a general idea of the country passed through, though somewhat confused as to details. The expedition left Riba Riba in April, 1898, and first ascended the valley of the Elila (Lira of Stanley) as far as Misisi, the road lying entirely through forest, in which, however, there are few large trees. From Misisi a north-east course was taken to the Ulindi, which proved an important stream, with a general width of 60 to 100 yards. The country traversed was generally flat and still wooded, and no villages of importance were seen; they must, however, exist, as clearings were constantly met with, and provisions were abundant. At Shabunda, where the Ulindi was struck, a chief is established who originally came from Ujiji. His village contains about 8000 inhabitants. Hereabouts the country becomes more broken, and though no well-marked chains of mountains are seen, the whole surface seems to form a *massif* running from north to south from near Lake Albert to Manyema, and forming the western versant of the Central African plateau. The rivers which flow west to the Congo have excavated deep tortuous channels, and the whole region is one of the most picturesque imaginable. The highest summits reach an altitude of over 5000 feet. Along the Ulindi the population is generally scanty, but Tata (heard of by Stanley in 1876) is thickly peopled. At a point not easily recognizable from the description the forest suddenly ceases, and an open plain is reached, covered with short fine grass. This country is known as Utembo, and its inhabitants are tall, well made, and warlike, fighting chiefly with spears. The Belgian expedition seems to have gained a passage through their country by force of arms. Each family possesses several head of cattle, as well as goats and sheep, and the groups of huts are surrounded by thick plantations of bananas. Until the middle of June rain fell about every other day, but then became less frequent, ceasing early in July. The expedition reached its goal at the village of Gwese, near the Rusizi, lying almost on the water-parting between the direct tributaries of the Congo and the basin of Lake Tanganyika. Its altitude is 5000 feet.

The Anglo-German Boundary Commission between Nyasa and Tanganyika.—Mr. Alfred Sharpe sends us some notes on the work of the joint commission which last year delimited the Anglo-German boundary north of Nyasaland. The English party consisted of Captains Close and Boileau, Lieut. Scratchley, and assistants, who commenced work in June, and had before December surveyed the whole boundary from lake to lake. All longitudes were based on that of a point on the telegraph line, inland from Nkata bay on Lake Nyasa, which was telegraphically fixed from Cape Town with a high degree of accuracy. In defining the 33rd meridian, on which the frontier as agreed upon in 1890 depends, it was found only 1100 yards distant from a point provisionally fixed by Mr. Sharpe and Lieut. Rhoades in 1897, working from O'Neill's position for Blantyre. Mr. Sharpe says nothing about the slight modification of the boundary involved by the discovery that the Songwe does not cross the 33rd meridian, so it may be supposed that the provisional arrangement alluded to in the *Journal* last year (vol. xi. p. 300) has been upheld. He says that he hopes to arrange for the suitable commemoration of the spot where Livingstone died during the coming dry season. The state of Nyasaland is reported as hopeful, a very large coffee crop being anticipated, and the rubber trade showing an increase.

The Museum of the Khedivial Geographical Society of Cairo.—On December 12 last, a museum of geography and ethnology in connection with the Khedivial Geographical Society was formally opened by the Khedive, in the presence of a gathering composed of ministers, members of the diplomatic and consular bodies, and others. An address was delivered by H. E. Abbate Pasha, setting forth the scope and objects of the museum, which is intended to bring together into one view collections representing the history and geography of Egypt and neighbouring territories from the original deposit of the Nile alluvium down to our own times. Although at present a nucleus only has been got together, it already possesses a valuable collection of maps—ancient and modern—portraits of great travellers, and so forth. An interesting point touched upon was the connection of the word "museum" itself with the ancient Egyptian *mes*, "a temple."

AMERICA.

Exploration of Alaska.—The impetus given to exploration, in Alaska no less than in British territory, by the recent gold discoveries, has been such, that during last year no less than six overland exploring parties were sent out by the United States authorities. A brief sketch of the work performed appears in the fifth number of the *Bulletin* of the American Geographical Society for 1898. The objects held in view are described as primarily the determination of the limits of the gold deposits, and incidentally the study of other resources of Alaska and of the facilities for railway and road making within that territory. Four expeditions were sent out by the Geological Survey, and two by the Army, a geologist being also attached to each of the latter. Two of the geological expeditions, under Messrs. Eldridge and Spurr respectively, started from the head of Cook's inlet, striking one north-east, the other north-west towards the Yukon; the other two (under Messrs. Peters and Barnard) reached the upper Yukon by the White pass; but whereas the one subsequently struck across from the White river to the Tanana, and down the latter to its mouth, the other held on its way down the Yukon, and executed a detailed survey over a large area east of Circle city, along the Dominion boundary. The two army expeditions, under Captains Glenn and Abercrombie, left the coast at points between the Copper river and Cook's inlet, and struck north and north-east by roughly parallel routes to the middle Yukon. Mr. Eldridge's route lay up the east branch of the Sushitna river (cf. *Journal*, vol. xi. p. 70), and he was able *en route* to fix approximately the position and height of Mount Bulshaia, already reported by prospectors. He gives the latter as 19,500 feet, which would make it the highest summit in the States. In the map which accompanies the paper, Mount McKinley, which has before been spoken of as identical with Bulshaia, is placed further north. Mr. Spurr's party crossed over to the headwaters of the Kuskokwim, down which they floated, and, after diverging to the lower Yukon, reached the mouth of the former river, and carried out further explorations along the coast and across the Aliaska peninsula. The difficulties encountered by all the expeditions were naturally great, and some lives are reported lost during the crossing of the Valdes glacier near the Copper river, by Captain Abercrombie's party. In addition to the above work, a survey of the Yukon delta was carried out by the Coast and Geodetic Survey, with the important result that a sufficient depth of water was found in one of the little-known southernmost channels, to permit the passage of ocean-going vessels.

Winter Journey in the Northern Rocky Mountains.—In the first number of the new volume of the Italian Geographical Society's *Bulletin*, Dr. D. R. de Simone gives a short account of a journey made a year ago through Northern British Columbia, across some of the wildest and least frequented parts of the Rocky mountains. Being in San Francisco at the height of the Klondike gold-fever in 1897, Dr. de Simone made up his mind to try to reach the Yukon overland from Vancouver, and chose the winter in order to avoid the difficulties arising from flooded streams. Arrived at Quesnelle, on the upper Fraser, January 5, 1898, most of the party who had accompanied him so far gave up the enterprise, and he proceeded with one companion only, a Norwegian miner named Johnson, to Fort

Conelly, on the upper Skeena. Here he obtained the services of three of the wandering Sikni Indians, who undertook to lead the way to the Omenika, one of the headstreams of the Peace. But after passing through a labyrinth of ice-covered mountains, the travellers found themselves on a more northern stream, the Inginika, and with difficulty made their way to Fort Graham, on the Finlay. An attempt of the Indians to desert by night with the sledges and provisions was only frustrated by the sagacity of Dr. Simone's St. Bernard dog. From Fort Graham the Finlay and its tributary the Thudaka were ascended, and pushing on desperately through the mountains, Dr. de Simone and his one companion at last struck the Stikine, and proceeded by Dr. Dawson's route of 1887 to the Liard. Thence they again struck west across the Kassiar range to Lake Teslin, on the eastern route to the Yukon. Their supplies being almost exhausted, and themselves threatened with scurvy, they now turned their steps southwards to Telegraph creek and Fort Wrangel. The rigour of the season and other difficulties of the journey precluded the possibility of any surveys. The country traversed is described as covered with dense bush and forests of huge conifers, the valleys and plains among the mountains being frequented by cariboo, bears, foxes, martens, etc.

AUSTRALASIA AND OCEANIC ISLANDS.

Australian Place-names.—The fifteenth volume of the *Transactions* of the Royal Geographical Society of Australasia (Victorian Branch) contains a paper by A. J. Wright on the nomenclature of an Australian colony. After showing how Australia differs from other parts of the world as regards its place-names from the low grade of its aboriginal inhabitants and their want of history, he expresses regret that better use has not been made of the opportunities afforded for introducing a well-considered and appropriate nomenclature. The names bestowed by the earliest colonists were on the whole dignified and euphonious, but the inrush of adventurers to the goldfields led to the conferring of grotesque and repulsive names which cannot be considered desirable. There is a great want of names recording natural features of the country, or trees, birds, and animals once common in districts now deserted by them, which would have been both interesting and instructive to future students. The suffixes which in English place-names are of so much use in indicating natural features of the past are altogether wanting in Australia. Another opportunity neglected has been that of recording the names of many of the early explorers on the map, while we do find other names having no connection with the colonies or their history. Mr. Wright also objects to the illogical application of native or pseudo-native words to centres of colonial industry, as leading to false conceptions. It is indispensable, in his opinion, that names should have some *raison d'être*—should describe or commemorate something, and this condition is not fulfilled in the case of the outlandish native names, which are out of all proportion to the native element in the population. Much more appropriate, he holds, would be the adoption of names connected with the past history of the Anglo-Saxon race, and especially of those men who by their wisdom or valour contributed to the welfare of the colonies. This part of the paper was the subject of some criticism in the discussion which followed, most of the speakers supporting the retention of native names.

Trigonometrical Survey Work in New South Wales.—According to the last annual report of the Department of Lands, New South Wales, the amount of trigonometrical survey work executed during 1897 was as follows: The main triangulation has been extended southerly along the coast to Wolumla station, thence westerly to Coolangubra (new) and Bukalong stations, and northerly to Glenbog station. Astronomical observations were made for determining latitude and azimuth at Wolumla, Glenbog, and Cooma stations; 2181 horizontal angles were measured, 184 stars were observed for latitude, 184 stars for azimuth, and 23 stars for time. At Cathcart, Stannard, Wangrah, and Cosgrove stations, 1167 horizontal and 648 vertical angles were measured. Magnetic observations were also made at those stations. Reserves for protection of stations were measured at Bimmil, Wolumla, Cathcart, Glenbog, and Stannard. A series of check levels was run between Bimmil station, and a bench-mark on the trial survey for a railway line between Bega and Eden. Observations were made at Wadbilliga, Bemboka, Burragate, Imlay, Skelton, Mowwarry, and Nagha stations; 1942 horizontal angles and 491 vertical angles were measured. Magnetic observations were also made at these stations. Reserves for the protection of fifteen stations were measured and marked, and seven connection surveys were carried out. Twenty new stations were piled and cleared in counties Buccleuch, Harden, and Wynyard, and the necessary reserves and connections measured. Twenty-five new stations were also formed in counties Cowley, Buccleuch, Wallace, and Wellesley, and the necessary reserves and connections measured.

Rabbit-proof Fences in New South Wales.—A few notes are given in the last Annual Report of the Department of Lands, New South Wales, regarding the progress of the measures adopted by the Queensland and New South Wales Governments to cope with the rabbit pest. The erection of a rabbit-proof fence from Mungindi, on the Queensland border, to the Namoi river, at Bugilbone, a distance of about 115 miles, was completed in March, 1897. Suggestions have been made for the continuation of this fence, from its termination at Bugilbone, either in an easterly direction to Narrabri, or southerly to the rabbit-proof fence on the boundary of Wingadee pastoral holding. The erection of the latter line of fencing, and the bridging of a gap which separates the netting fences on the boundaries of Gooriana wa and Goolthi pastoral holdings, would bring into existence an additional barrier, some hundreds of miles in length, which would protect nearly the whole of the counties of White and Baradine, including the well-known Pilliga scrub, and practically render the greater part of the north-eastern portion of the colony free from the inroads of the pest. The aggregate number of miles of rabbit-proof fencing erected in the colony has increased to 17,280. A map illustrating this subject is given at the end of the report, which shows that along the whole western boundary no rabbit can cross the frontier, while two-thirds of the northern boundary is similarly protected. The work is thus not one of merely local interest, for it may be said to add a new type of boundary—the artificial biological barrier—to those hitherto recognized in political geography.

Government of Dutch New Guinea.—A note in the *Geographische Zeitschrift* (1899, part 1) announces that the Dutch authorities have at last determined to bring their portion of New Guinea under a certain degree of control, their suzerainty having, since the evacuation of Fort Du Bus in 1838, been exercised solely through the Sultan of Tidore, their vassal. Two commissaries will in future represent the Dutch power directly, each supported by a small force of armed native police commanded by a European, and provided with a steam-launch, also manned by natives. The headquarters of the commissaries will be Manokwari, on Dore bay, for North New Guinea, and Fatak, in the Kapar district, for the south-west.

POLAR REGIONS.

Swedish Andrée Search Expedition.—The energetic Swedish arctic explorer, Dr. Nathorst, has issued an appeal for funds in aid of an expedition to search for Andrée next summer along the east coast of Greenland. It is the opinion of many experts, Dr. Nansen included, that this is the most likely direction for the balloon to have taken, and it is still hoped that Andrée and his companions may have landed in that region. Should they have proceeded along the north-west coast, they may have already fallen in with Peary or Sverdrup, and be now in safety, but should they have tried to advance southwards along the coast, they would find no inhabitants before reaching Angmagsalik, in 65° 50′ N. Dr. Nathorst therefore insists on the importance of searching the coast between 73° and 76° north, and reckons that an expedition for this purpose will involve an expenditure of 70,000 kronor, including repairs, etc., to the *Antarctic*—which will be at the disposal of the search-party—supplies, and scientific equipment. On February 13 it was reported that 30,000 kronor had already been promised. The report that the bodies of Andrée and his two companions, with remains of the balloon, had been found in the interior of Siberia is regarded as without foundation.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Professor Geikie on Land-forms.—The new Progressive Science Series, published by Mr. Murray, and edited by Mr. F. E. Beddard, contains several volumes devoted to departments of physical geography by writers of high eminence. Of these Prof. James Geikie's work * has a special interest to geographers, on account of the plan which he proposes for the nomenclature and classification of land-forms. The leading land-forms are given as "Plains, plateaux, hills and mountains, valleys, basins, and other hollows and depressions of the surface, and lastly coast-lines." *Plains* are recognized as regions which are approximately flat or gently undulating, and as a rule of slight elevation, and they are divided, according to the mode of origin of their superficial layers, into plains of accumulation, the surface of which corresponds to the internal geological structure and plains of erosion, the surface of which bears no necessary relation to the structure. *Plateaux*, or tablelands, are not sharply distinguished from plains, and are classified in the same way, the tendency of plateaux to be cut up into segments by erosion being noted. *Hills* and *mountains* are not clearly separated, but the limit of 1000 feet of elevation is suggested as the minimum to which the name of mountain should be applied; but, for purposes of classification by structure, the term "mountain" is used to include both. Two great divisions are recognized: (*a*) Original or tectonic mountains, subdivided into mountains of accumulation (volcanoes, sand-dunes, etc.), and of deformation (including folded or flexured, dislocation, and laccolith mountains); and (*b*) Subsequent or relict mountains, produced by denudation, and comprising many typical forms due to the action of erosion on different geological structures, resulting in synclinal mountains, escarpments, and necks. *Valleys* are similarly divided into original or tectonic, formed either by hypogene action or by epigene action other than that of running water (including constructional and deformation valleys, the latter subdivided into dislocation and synclinal valleys) and subsequent or erosion valleys produced by the work of running water. *Basins* or hollows in the surface are classed according to origin as tectonic, volcanic, dissolution, alluvial, æolian, rockfall, and glacial. *Coast-lines* are distinguished into regular or smooth and irregular or indented. The author keeps before the reader constantly the great fact that the only clue to the classification of land-forms is the history of the evolution of the land surface.

The Asymmetry of the Northern Hemisphere.—Under this title Prof. Suess summarizes our knowledge of the great structural lines of the northern hemisphere, as derived from the recent investigations of geologists, in the 'Reports' of the Vienna Academy of Sciences (*Math. Naturw. Classe*, vol. 107, p. 89). He lays down the following great systems of mountain folding: A series extends over Northern Asia from the Kanin peninsula to Bering sea, which either differs entirely from the great Eurasiatic system or does not fall in with the general plan of the latter. The folds are concave towards the pole, and curved towards the west, south, or east. They have no equivalent in North America, except possibly in the coast ranges of British Columbia. Next, a great amphitheatre, also concave towards the north, surrounds Lake Baikal and the East Siberian plain; the whole great series of curves from Sakhalin to Java, and to the Himalayas and the Persian gulf, possesses in its broad features a homologous arrangement. The next system starts from the Thian Shan, and is continued through the Central European ranges to the Hebrides; it follows to a certain extent the Asiatic arrangement, and is to be considered as an extension of the latter. As regards its relations to the Atlantic, the conclusion may be drawn that, while certain of the lines were never continued beneath the ocean, a wide archæan region once occupied its northern basin—a conclusion also borne out by facts observable in eastern North America. The general system of folds in the latter continent differs from that of Eurasia, in that they are concave, due to a motion of the mass inwards; the European chains form the intermediate link between the Asiatic and American structure. This difference in structure between Asia and America (which has given rise to the divergent views as regards the continents and their relation to the oceans which have found favour with the students of the two regions) justifies the conclusion that a lateral asymmetry has existed in the northern hemisphere ever since the Cambrian epoch. As regards the question of the permanence of oceans and continents, therefore, the general conclusion is that since the epoch just named the positions of the regions of outward and inward movement and of the lines of surface tension have remained the same in the northern hemisphere, though a similar degree of permanence does not apply to the oceans. The outlines of the continents and seas change in spite of the continuity of the fundamental lines.

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* 'Earth Sculpture, or the Origin of Land-forms.' By James Geikie, LL.D., D.C.L., F.R.S. London: John Murray. 1898.

GENERAL.

The Sites of Great Commercial Centres.—In the *Bulletin* of the American Geographical Society (1898, No. 4), Major A. F. Sears discusses the geographical conditions that make great commercial centres, endeavouring to lay down a general rule to account for the positions they occupy. The keynote of the discussion is the statement that trade always follows natural, not artificial laws. The paper is thoughtful and instructive, though perhaps too much prominence is given to one determining factor, to the exclusion of other possible causes. From the consideration of a number of instances, mostly taken from the United States, the author deduces the law that trade will always come as near as possible to the centre of production of a country, even passing by commodious harbours easily reached from the ocean, and, to attain the above end, choosing others which may involve difficulties of navigation or considerable addition to the length of the voyage. Thus Boston, in spite of being nearer to Europe and of the amount of capital expended on the port, has had to give way to New York, which is over 200 miles nearer the centre of the country. In a similar way the position of Philadelphia, Baltimore, Houston, New Orleans, and many other ports, is explained, as also the growing importance of Montreal as compared with Quebec. On the west coast, Portland has in the same way flourished at the expense of Astoria, Kalama, and St. Helen's. The reason for the importance of Seattle, as compared with Tacoma, cannot be thus explained, but Major Sears says the "producing region" does not lie in the direction of the last named. In the region of the lakes, however, the positions of Cleveland, Detroit, and especially Chicago, are explained from their nearness to the heart of an exceedingly productive country. In Europe, the Irish ports, as also Glasgow, London, and Hamburg, are cited as instances. The writer attempts, not always quite satisfactorily, to account for apparent exceptions to the law, which he holds to be in reality "without exception in the world's economy." The position of San Francisco is accounted for as due to the need of accessibility to the numberless little inlets along the Pacific shores. The trade of New York has not gone further up the Hudson, because it is the port not of the valley of that stream, but of half the continent. Liverpool has not declined since the opening of the ship canal, because it is as near a large part of the producing area as Manchester. Other great ports, not touched upon, could hardly be brought under the action of the law, as, *e.g.*, Aden, Hong-Kong, Singapore, and Zanzibar, and this seems to show that other causes must also be taken into consideration, in order to render the study complete from all points of view. It will be seen that the commercial centres spoken of are all *ports*, and the law is, after all, chiefly an outcome of the fact that water-carriage is cheaper than land-carriage.

Kubary's Ground-dove.—The ground-dove of the Caroline islands, discovered by Kubary, and named after him by Dr. Finsch (as mentioned above, p. 107), is *Phlogœnas Kubaryi*, not "*Phlegyas*," as there incorrectly written. It is a fine species. There are four specimens of it from the island of Ruk in the British Museum. Two of these were obtained by Kubary himself, and two by Dr. Finsch, who visited the Carolines in 1880. See Dr. Finsch's Ornithological Letters from the Pacific in the *Ibis* for 1881.

CORRESPONDENCE.

Hannibal's Pass: Some Points on the Classical Authorities.

My friend Mr. Bullock Hall's very interesting work, 'The Romans on the Riviera and the Rhone,' has recalled me to the old subject of Hannibal's pass, which has always attracted me, perhaps from a lawyer's fondness for weighing evidence. And I am presumptuous enough to think that there are one or two sides of the question not yet exhausted, attention to which will tend to confirm the opinion in favour of the Argentière which Mr. Douglas Freshfield has so ably maintained in the *Alpine Journal*, No. 81, and in the *Proceedings R.G.S.* for 1886.

First, in Hannibal's time the world of the Romans comprised the plains of the Po as far as the Insubres inclusive, or, at any rate, as far up as the hills of Montferrat and Asti, but the screen of hill and mountain to the west, and Gaul beyond it, were beyond their ken. Hannibal's operations were therefore well known to them from the time of his contact with the Insubres, but any details which they may have heard about the way by which he reached that point would, at the best, be complicated with names of places or tribes conveying to them no clear geographical notions. They would be ill understood, and probably worse repeated and handed down. But from the time when the Romans penetrated into the region between the Alps and the Rhone they inevitably became acquainted with the country which they governed, and with the traditions of the great Carthaginian's passage through it which the tribes must have preserved, and the details concerning that passage must have been matter of keen professional interest to the Roman commanders. Then, at any rate, they knew the truth about Hannibal's route and pass. The case is therefore one in which the later authorities are to be preferred to the older. When we try to enumerate the older authorities which any later author, as Livy, had before him, in order to arrive at a measure of his trustworthiness, we suffer under an illusion as to the latter's sources of information arising from the painful examination of texts from which we are obliged to draw our own knowledge. Livy and his contemporaries wrote of and from what was familiar and certain knowledge to all about them who had any connection with provincial affairs. Varro was not only the most learned man of his age, but was himself a general and had been employed as such in the region, and to dispute his statement on the point would be no wiser than for a critic of the year A.D. 3000 to dispute the statement of a French staff officer of the year A.D. 1900 as to the pass by which Napoleon crossed the Alps before the battle of Marengo.

Secondly, Varro's statement that Hannibal passed by the Argentière is so clear as scarcely to admit of misinterpretation, but since Livy mentions no topographical name after the Durance it has been thought that his account will apply to the Mont Genèvre equally with the Argentière. This, however, I submit is a mistake. According both to him and to Polybius it was before the attack on the city of the Taurini that Hannibal allowed his troops an interval of rest, the duration of which (*stativis*), and the abundance and comfort which they enjoyed in it, Livy emphasizes. Now this was possible in the rich plains between the foot of the Argentière and Turin, but scarcely so on the descent from the Mont Genèvre, that is in the narrow valley of the Dora Riparia, or in the very short strip (7 miles) of plain country between the entrance to that valley and Turin. Even therefore if Livy were our only witness to what was known at Rome in his time, I should feel myself obliged to conclude in favour of the former pass, in happy consonance, as the fact stands, with Varro.

Thirdly, Polybius is usually quoted as a single authority, but it appears to me that we have two accounts from him written at different periods of his life. When he composed the narrative in his third book he did not know which was Hannibal's pass, or, indeed, anything very clear about his route; the statement that Hannibal's pass was that through the Taurini, which Strabo quotes from him, was most likely made in his thirty-fourth book, which is said to have been a sort of treatise on geography, but was, at any rate, made after he had lived to share in the knowledge which was acquired through the advance of the Romans into Gaul. In his third book, when he tries to arrive at the total length of march from Carthage to Italy, Polybius says that from the passage of the Rhone to the beginning of the ascent of the Alps there are 1400 stadia for those who follow the very river in the direction of its source—πορευομένοις παρ' αὐτὸν τὸν ποταμὸν ὡς ἐπὶ τὰς πηγάς (Hist. iii. 39). This means that he does not profess to give the distance actually marched by Hannibal through districts unknown to him (Polybius), but gives the known distance along the river as the nearest approximation to it that he can. Accordingly, when he says that, after his halt among the Allobroges, Hannibal marched 800 stadia in ten days to the beginning of the ascent of the Alps, he no longer speaks of the very river, but uses a looser expression—παρὰ τὸν ποταμόν (iii. 50). Of course this would be translated "along the river" if it stood alone, but the significant contrast with παρ' αὐτὸν τὸν ποταμόν obliges us to translate it by "parallel to or in the general direction of the river." Whether the march was really in that general direction, at least above the confluence of the Drac, is a matter on which the geographical insufficiency of Polybius is now too well understood for his statement to carry any weight.

Here the question may be incidentally noticed, What river did Polybius mean, the Rhone or the Isère? He meant neither, as such, whether in iii. 39 or in iii. 50. He had in his mind, as a kind of standard from which Hannibal deviated, the trade route over the Little St. Bernard; and his "river" was the river along which that route passed, namely the Rhone as far up as the junction of the two, and the Isère above that point.

When, later, Polybius became aware that Hannibal crossed the Alps by the Argentière, he described it as the pass "through the Taurini" without any practical ambiguity for his time, because the Mont Genèvre was opened afterwards by Pompey, and the Mont Cenis, though Varro tells us that Hasdrubal used it, was not much known. He did not alter or add to what he had written in the third book, because he well knew that he had not there named or identified the pass, so that the description, which he meant to be as vivid as he could make it, needed no correction or completion.

Fourthly, the language in which Varro, as quoted by Servius on Virgil, describes the first two passes, reckoning from the Mediterranean, is just a translation of that which Strabo quotes about them from Polybius, except that the words "through the Taurini" are omitted from the mention of the second of them. The Mont Genèvre having been opened and the Mont Cenis become better known, the omitted words were no longer specially descriptive of the Argentière, for all three descended among the Taurini. And thus we have a significant illustration of that gradual growth, in the knowledge of the Alps and what had happened among them, which I submit ought to be taken as a cardinal fact in our appreciation of the authorities. We have three stages before our eyes: the Polybius of the third book of the Histories, the Polybius of the thirty-fourth or some other book, and the final stage of Varro and Livy.

I do not trouble the reader, or even myself very much, with the details of the famous march. They are interesting not only in themselves, but also because the difficulties and hardships so impressed the survivors with whom Polybius talked that their account of them, or what he understood and remembered as such, stood out in his mind apart from any geographical setting, like the scenes in a bad dream which may have happened anywhere or nowhere. But, so far as I am competent to express an opinion, Mr. Freshfield has successfully answered the serious questions which arise, and has given a true representation of the march.

J. WESTLAKE.

Chelsea, January 21, 1899.

'The Marvellous Adventures of Sir John Maundevile.' *

MR. LUGARD's new edition of Sir John Maundevile's Travels, being rendered into modern English, is easier to follow than the old editions in the original spelling, and may, it is probable, induce many people to read it who have been deterred by the effort and time necessary to study the old versions. It is illustrated with new designs, of which nothing need be said. What is intended here is to endeavour to rehabilitate the character of this well-known author, whose work has gone through so many editions and been translated into so many languages during the past five hundred years, more, perhaps, than any other traveller, and whose name has been almost made a synonym for falsehood, somewhat unjustly, as it seems to me.

I regret that Colonel Yule † has laid the great weight of his authority against our traveller, who, he intimates, never did travel in the East, but took all his information from Friar Odoric, who travelled in the East in 1316–28. The earliest known notice of this last work, according to Colonel Yule, was in 1348–50. Maundevile's book appears to have been written in 1346, "the 34th year that I departed from our countries." He was, therefore, if we accept his own accounts, on his

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* Constable & Co. 1895.

† 'Cathay, and the Way thither' (Hakluyt Society: 1866), pp. 27–29.

travels the whole time that Odoric was in the East, and they may possibly have met. Maundevile in one place refers to two friars who accompanied him. This, according to Yule, is a piece of craftiness on Maundevile's part. There is no doubt that in certain regions his account and Odoric's are nearly identical, and it is quite possible Maundevile may have copied such portions, if he had become acquainted with the contemporaneous work, or they may have been derived from a common source; but even Yule admits that Maundevile's readings of the proper names have positive value for collation, and have suggested amendments of the text (Odoric's). At any rate, Maundevile's account of Egypt is not from Odoric, nor his dissertation on the shape of the Earth, which I have not found treated of anywhere else later than Eratosthenes, of the third century B.C., except in Friar Bacon's great work (of which more hereafter), of whose work he seems to have had some knowledge. As regards the territories of the far East, Maundevile states that he served the great Khan as soldier for fifteen months against the king of Mancy.

With reference to his account of Palestine, etc., being "appropriated" from Odoric, it seems quite as probable that both got their accounts from the monks in that country.

He appears to me, on the contrary, to have been a well-informed man and careful observer, and correct about places he had seen himself, and far ahead of his age in many respects. He was a conscientious, religious man, for does not he relate how the Soldan of Egypt* "wolde have maryed me fulle highly, to a gret Prince's Daughter, yif I wolde hav forsaken my Lawe and my Beleve. But I thanke God, I had no wille to don it, for nothing that he behighten me"? He also tells us plainly about "this Tretys, that I had made after informacioun of men, that knewen of things that I had not seen myself, and also of Marveyles and Customes that I hadde seen myself,"—therefore, professedly, only in part from his own observation.

Then the astute gentleman, on return from his long wanderings, called at Rome on his way home, and "was assoylled of all that lay in my conscience, of many a dyverse grevous poynt." He also showed the Pope his book, which was examined and approved by the Pope's Council. How the Council gave their imprimatur to a book containing the then heterodox doctrine of the spherical form of the Earth, is difficult to conjecture.

Our author, then, I would accept as an honest man, steeped in the credulity of the age, accepting without demur, and in simple faith, all that was told him by the ecclesiastical authorities in Palestine, and believing all the Eastern legends and stories he heard, and incorporating them in his book. He was not the *inventor* of these tales, which, on the contrary, come down from remote antiquity. Herodotus has many of them, and they were then generally believed throughout the East.†

One cannot but be struck by the difference between these wild legends and the sober and accurate accounts of places he had visited, such as Egypt, the Persian gulf, Tartary, etc. His description of the Beduin, for instance is, I think, inimitable, and shows an intimate knowledge of that people, who are now just the same as they appeared to him. To his contemporaries the account of the great Khan's court was, no doubt, not less wonderful or incredible than many of the myths related.

But I am chiefly concerned with him as a scientific geographer, for such is the title he deserves, as he shows a clear understanding of the sphericity of the Earth, and of its approximate dimensions, with a freedom in discussing the question, which is really surprising, when we consider how original thought was then repressed. In the quotation following, which is rather long, I have followed the modernized text of Mr. Lugard. Sir John's argument is as follows: "From Hindustan" (apparently, judging by the description of the pilgrims letting the car-wheels go over them) "men go by sea and many dyverse Yles and by many countries, fifty-two journeys, to a land called Lamary" (possibly South Africa),* where the people wore no clothes and were cannibals. Now comes the remarkable part—"In that land, and in many others beyond that, no man may see the star Transmontane (Pole star), that is unmoveable, and that is towards the North, that we call the Lodestar. But men see another star, the contrary or opposite to it, that is toward the South, that is clept Antarctic, . . . the which star appeareth not to us . . . For which cause men may well perceive that the land and sea be of *round shape and form.* For the part of the firmament sheweth in one country that sheweth not in another country. And men may well prove by experience and subtle compassing of wit, that if a man found passages by ships, that would go to search the world, he might go by ship all round the world and above and beneath. For I have been towards the ports of Brabant and beheld by the Astrolabe that the star that is clept the Transmontane is 53 degrees high, . . . and farther towards the Septentrional (or northern) parts, it is 62 degrees of height and certain minutes, for I myself have measured it by the Astrolabe.

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* These quotations are taken, for their quaintness, from the edition of 1725, from the Cotton MS.

† The sources whence these myths were derived are given in the edition of 1725. They were, in fact, "chestnuts."

"Now ye shall know that over against the Transmontane is the tother star that is clept Antarctic as I said before. And those 2 stars never move, and on them turneth all the firmament right as doth a wheel that turneth on his axletree. (Of course neither the Polar star, nor still less any southern circumpolar star, can be said *not* to move.)

"After this I have gone toward the meridional parts, that is toward the south, and I have found that in Lybia men see first the star Antarctic. . . . After going by sea and by land towards this country, of which I have spoken" (he calls it Lamary, a land of cannibals, who go all naked), "and to other isles and lands beyond that country, I have found the star Antarctic 33° of height and some minutes. And if I had had company and shipping to go more beyond, I trow well, as certain, that we should have seen all the roundness of the firmament all about. . . ."

He then explains that by going north 62° 10', and south 33° 10' he has seen three parts of "all the roundness of the Firmament, and more yet by 5 degrees and a half. By the which, I say to you certainly that men may environ all the earth of all the world as well underneath as above and return again to their country, if that they had company and shipping and conduct. And they should always find men, lands, and isles as well as in this country. For wit ye well, they that be towards the Antarctic be straight, feet against feet, to them that dwell under the Transmontane as well as they that dwell under us be feet against feet." This is very explicit; and he then relates how he had heard of a man who reached the same "Isle"† starting in opposite directions round the world. He further proceeds with his arguments thus: "But how it seemeth to simple men unlearned that men may go under the earth, and also that men should fall towards the heaven from under. But that may not be, any more than we may fall toward the heaven from the earth where we be. For on whatever part of the earth that men dwell, either above or beneath, it seemeth always to them that they go more upright than any other folk. And right as it seemeth to us that they be under us, right so it seemeth to them that we be under them. For if a man might fall from the earth unto the firmament, by greater reason the earth and the sea, that be so great and heavy, should fall to the firmament, but that may not be. . . ."

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* Sir Henry Yule says this is Sumatra.

† The peculiarity of calling any foreign country an Isle is found also in the 'Arabian Nights.'

He then discusses the size of the Earth, as follows: "For the earth is full large and full great, and holds in roundness and environment about by above and beneath 20,425 miles after the opinion of the old wise astronomers, and this saying I reprove not. But after my little wit it seemeth me, saving their reverence, that it is more. . . ." His conclusion is, "And wit well that after the authors of astronomy, 700 furlongs of the earth answer to a degree of the Firmament, and those be 87 miles and 4 furlongs; now be that multiplied by 360 times, and then they be 31,500 miles 8 furlongs after the miles of our country."

All this seems to me immensely in advance of anything I have found in any writer of that period. Where did he get his ideas from? If, as Yule concludes, he was a mere impostor, and had not really travelled, what I would observe is, that these exact views about the Earth are the more marvellous. Purchas had a different opinion of him, and calls him the greatest traveller that ever the world had. If Maundevile's statement that he had been in 33° S. lat. be anywhere approaching to correctness, he must have been nearly as far as the Cape of Good Hope—probably, chiefly by sea, *viâ* the Mozambique. Ibn Batuta, who travelled about the same period, viz. 1325–55, appears certainly to have gone down the Mozambique by sea to 9° S. lat. But if Lamary be Sumatra, as assumed by Colonel Yule, it would appear as if he had visited Australia. I think the former the less improbable. There is little doubt that long before his time there was trade between Arabia, India, and the east coast of Africa, while Australia was apparently undiscovered. In the introduction to Astley's 'Collection,'* we find that the Arabs extended their commerce southward along the eastern coast of Africa, beyond Sofala, to above 20° of south latitude.

Such a remarkable man as this is surely not to be dismissed as an ignominious impostor. I yet hope that some one, more competent than myself, will do for his whole book what Yule has so well done for Marco Polo.

It is a pity that our author felt it necessary to bolster up the theory, then thought orthodox, that Jerusalem occupied the centre and highest part of the world, considering that he has shown he knew better. This may have been a sop to the ecclesiastical authorities, and has a grotesque effect after reading the dissertation given above.

I cannot find any one between Maundevile and Columbus who maintained the sphericity of the Earth, and the possibility of its circumnavigation. He appears to have been acquainted with the old Greek geographers' work. He *may* also have had access to Friar Bacon's researches about the figure of the Earth. This latter wonderful man died about 1292–4, or over twenty years before the beginning of Maundevile's travels; but as Bacon was previously imprisoned for many years on account of his writings, they must have been difficult of access. Sir John's attempted correction of the ancients' determination of the size of the Earth is, I believe, his own.

A characteristic feature of this curious book is his habit of quotation from Scripture (not always correctly) of any text which he considers bears on his observations, or supports his conclusions.

A. W. STIFFE

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* 'Collection of Voyages and Travels.' London. 1745.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898-99.

Afternoon Technical Meeting, Friday, January 27, 1899, *at* 4 *p.m.*—SIR CLEMENTS MARKHAM, K.C.B., President, in the Chair.

The Paper read was :—

"On the Sub-Oceanic Physical Features off the Coast of Western Europe, including France, Spain, and Portugal." By Prof. Edward Hull, LL.D., F.R.S., F.G.S.

Fourth Ordinary Meeting, January 23, 1899.—SIR CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Alexander Dick-Cunyngham ; Thomas Richard Glyn ; John James Willoughby Livett ; Major Henry Steuart Lockhart-Ross (5th Lancashire Fusiliers) ; Frederick Vavasour McConnell ; John Edward Moore ; Samuel Perkes ; Lieut. W. B. Phillips, R.N.E. ; G. H. St. Hill ; F. G. Snelson ; John Loudon Strain, M.Inst.C.E. ; R. Willis (H.M.B. Consular Service, China) ; George Wyndham, M.P. (Under-Secretary of State for War).*

The PRESIDENT: I may mention to the meeting that we welcome here this evening a most distinguished South American geographer in Don Francisco Moreno, whose work is well known in this country, and who has explored regions in Patagonia of which we previously knew nothing. He has come over here in connection with the arbitration which has been referred to our Queen, and we hope in the course of the session we may receive one if not two interesting papers from Don Francisco.

The Paper read was :—

"The Plan of the Earth and its Causes." By Dr. J. W. Gregory.

Fifth Ordinary Meeting, February 13, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Edward Arnold ; R. Corfield Bucknall ; Henry Cæsar Childers ; Frederick W. Christian, B.A. ; James Frederick Cornish ; James Francis Cunningham ; James Grön ; Edward Herdman ; Robert Martin Holland ; Thomas Locking Hughes ; Homer Beza Hulbert ; Lieut. Henry F. N. Jourdain (The Connaught Rangers) ; Sultan Mahomet Khan, Mir Munshi of Kabul, Afghanistan ; Cyril L. C. Locke, M.A. ; S. S. McFarlane, L.R.C.S., L.R.C.P. ; Deodoro Moegle ; Captain H. N. Roome (6th Bengal Cavalry) ; C. Rozenraad ; Sir John Scott, K.C.M.G. ; Colonel Frederick George Slade, C.B. ; Rev. Theodore A. Teitelbaum ; Herbert Maxwell Warne ; Rev. J. P. Woodward, B.A.*

The PRESIDENT said : I think it will interest the meeting to know that we have received a very interesting letter from the second in command of Major Macdonald's expedition to Lake Rudolf, Captain Austin of the Royal Engineers. He appears to have followed up the whole west side of Lake Rudolf, taken careful observations, and ascertained that the lake is a good deal further to the north, about 20 or 30 miles, than was previously supposed. It shows us we may confidently look forward to valuable and correct maps of that little-known region, when Major Macdonald returns. I think I may also ask you to welcome back our friend Sir Martin Conway, who has made, in a few months, journeys and ascents which it would have taken most people a few years to accomplish. He has reached the summits of Illimani and Aconcagua, has been nearly to the summit of Illampu, and got within a thousand feet of Mount Sarmiento, near the Magellan straits, a remarkable piece of work in such a short time. I will also ask you to welcome a distinguished professor from the university of Santiago de Chile, who has come here to assist the arbitrators to delimit the boundary between Chile and the Argentine republic. It will take some time and require great consideration, and I hope we may frequently have the pleasure of seeing Prof. Bertrand at our meetings here.

The Paper read was:—

"Exploration in the Canadian Rockies: a Search for Mount Hooker and Mount Brown." By Prof. Norman Collie, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Andorra. *Annuaire Club Alpin Français* **23**, 1896 (1897): 311-345. **Régnault.**

L'Andorre. Par M. Félix Régnault. *With Illustrations.*

A visit to Andorra in 1895. The paper includes a list of sixteen books and articles on Andorra.

Austria-Hungary. ———

Publicationen für die Internationale Erdmessung. Die Astronomisch-Geodätischen Arbeiten des k. und k. Militär-Geographischen Institutes in Wien. XII. Band. Astronomische Arbeiten. 4. Längenunterschied-Messungen Kronstadt—Budapest Sarajevo—Kronstadt, Sarajevo—Pola; Polhöhen- und Azimuth-Bestimmungen auf den Stationen: Bösig, Donnersberg und Jeschken. Herausgegeben vom k. und k. Militär-Geographischen Institute. Wien, 1898. Size 12 × 9½, pp. vi. and 278.

Basques. *Globus* **74** (1898): 333–340. **Karutz.**

Zur Ethnographie der Basken. Von Dr. Karutz. *With Illustrations.*

Critical remarks on some theories of the origin of the Basques, with descriptions of various carts, sledges, and implements, acquired by the author in the Basque districts of Spain and France for the Ethnographical museum in Lübeck.

Belgium—Bruges. *B.S.R. Belge G.* **22** (1898): 376–395. **Du Fief.**

Bruges et le nouveau canal maritime. Par M. J. Du Fief.

Belgium—Geology. **De Windt.**

Travaux du Laboratoire de Minéralogie et de Géologie de l'Université de Gand. Sur les relations lithologiques entre les roches considérées comme cambriennes des massifs de Rocroi, du Brabant et de Stavelot. Par Jean De Windt. Bruxelles, 1898. Size 12 × 9½, pp. 96. *Plates. Presented by the Author.*

Europe—Climate. *Z. Ges. Erdk. Berlin* **33** (1898): 183–200. **Meinardus.**

Der Zusammenhang des Winterklimas in Mittel- und Nordwest-Europa mit dem Golfstrom. Von Dr. Wilhelm Meinardus. *With Diagrams.*

A study of the climatic conditions of Europe during the exceptionally mild winter of 1897–98, and the exceptionally cold winter of 1880–81, with special reference to the distribution of atmospheric pressure and the movements of the Gulf Stream.

France. *Rev. Maritime* **132** (1897): 257–285. **Loir.**

La livraison de Toulon aux Anglais (1793). Par M. M. Loir.

France. *Annuaire Club Alpin Français* **23**, 1896 (1897): 137–188. **Nœtinger.**

La Suisse niçoise. Par M. Fernand Nœtinger. *With Illustrations.*

On the valley of the Vésubie and the surrounding country in the neighbourhood of Nice.

France. *Annuaire Club Alpin Français* **23**, 1896 (1897): 509–523. **Villars.**

Voyage de Grenoble à la Grande-Chartreuse, le 8 messidor an XII.: manuscrit inédit de Dominique Villars, avec un avant-propos de M. Paul Guillemin.

A mountain journey undertaken on June 27, 1804.

France—Mont Blanc. *C. Rd.* **127** (1898): 942–945. **Hansky.**

Sur la détermination de la pesanteur au sommet du mont Blanc, à Chamonix et à Meudon. Note de M. Hansky.

France—Pyrenees. *Annuaire Club Alpin Français* **23**, 1896 (1897): 227–270. **Belloc.**

Les sources de la Garonne, récits de courses et d'expériences. Par M. Émile Belloc. *With Illustrations.*

The author takes the Col de Bérét as "the official and rational source of the French Garonne."

France—Vivarais. **Bourdin**

Le Vivarais. Essai de Géographie Régionale. Par Louis Bourdin. Paris: F. Alcan, 1898. Size 10 × 6½, pp. 262. *Illustrations. Price* 5*s.*

Germany. *Naturw. Wochenschrift* **13** (1898): 541–548, 553–557. **Graebner**

Ueber die Bildung natürlicher Vegetations-formationen im Norddeutschen Flachlande. Von P. Graebner.

On the forests and other features of the botanical geography of the North German plain.

Germany—Black Forest Lakes. *Petermanns M.* **44** (1898): 241–251. **Halbfass.**

Zur Kenntnis der Seen des Schwarzwaldes. Von Dr. W. Halbfass. *With Map.*

Dr. Halbfass has sounded and described a number of small lakes in the Black Forest, of which he gives bathymetrical maps. See *ante*, p. 300.

Germany—Commercial Education. **Powell.**

Commercial Education in Germany. Foreign Office, Miscellaneous, No. 483, 1898. Size 10 × 6½, pp. 30. *Price* 2*d.*

This report points out that the improvement in commercial education in Germany has followed, and not preceded, the great development in German trade. It goes on to detail the subjects of instruction in German commercial schools, and gives a number of selected time-tables.

Italy—Piedmont. **Worsfold.**

The Valley of Light. Studies with pen and pencil in the Vaudois Valleys of Piedmont. By W. Basil Worsfold. London: Macmillan & Co., 1899. Size 9½ × 6, pp. x. and [illegible]. *Map and Illustrations. Price* 10*s. Presented by the Publishers.*

In the form of a series of letters to a lady written from various places in the Vaudois Valleys, the author gives a historical account of the great feat of arms by which the persecuted Waldenses made their way back to their native valleys at the end of the sixteenth century, the description of the events being associated with the actual scenes in which they occurred.

Mediterranean. *B.S.G. Lille* **30** (1898): 262–287. **Paillot.**

Voyage au pays des Croisés. Par M. R. Paillot. *With Illustrations.*

A cruise in the Eastern Mediterranean.

Russia—Lakes. **Anuchin.**

Lakes in the region of the sources of the Volga and Western Dwina. By D. I. Anuchin. [In Russian.] Moscow, 1898. Size 10½ × 7, pp. 56. *Maps and Illustrations. Presented by the Author.*

Russia—Novaya Zemlya. **Feilden.**

The Flowering Plants of Novaya Zemlya, etc. By Colonel H. W. Feilden. (Reprinted from the *Journal of Botany*, October to December, 1898.) Size 9 × 6, pp. 36. *Presented by the Author.*

Spain and France. *Annuaire Club Alpin Français* **23**, 1896 (1897): 368–413. **Martel.**

Sous Terre (Neuvième Campagne 1896) Cueva del Drach, à Majorque.—Scialets du Vercors. Chouruns du Dévoluy. Par M. E. A. Martel. *With Plans and Illustrations.*

Records of speleological research, most space being given to the Dragon Cave in Majorca, and briefer reports of the caves of Dauphiné.

United Kingdom—England. **Hyde.**

The Low Peak. By John Hyde. (From the *Gentleman's Magazine*, November, 1898.) Pp. 480–490.

United Kingdom—Ireland. *P.R. Irish A.* **5** (1898): 40–72. **Browne.**

The Ethnography of Clare Island and Inishturk, County of Mayo. By Charles R. Browne, M.D. *With Plate.*

A continuation of the careful anthropological measurements and study of the people of the west coast of Ireland; the people of Clare island appear to be the descendants of the people who lived on the island two or three hundred years ago, with little change or intermixture.

United Kingdom—Scotland. **Douglas.**

The Climbers' Camp at Coruisk. By W. Douglas. (From the *Scottish Mountaineering Club Journal*, January, 1898, pp. 1–16.) Size 9 × 6. *Map and Illustrations. Presented by the Author.*

This paper contains a map of the Coolins on the scale of 6 inches to 1 mile, with new data not included in the Ordnance Survey map, as well as some soundings in Loch Coruisk.

Western Europe—Coal. **Combes.**

A travers le Monde, Tour du Monde **4** (1898): 365–366.

Existe-t-il de la houille dans le Pas-de-Calais? Par M. Paul Combes.

The argument stated is that the coal-basins of South Wales, Bristol, Dover, the north of France, south of Belgium, Aix-la-Chapelle, and the Ruhr valley, are part of a continuous sheet of the coal-measures, although trial borings in the department of Pas-de-Calais has found only scattered and slight indications of underlying coal.

ASIA.

Asia—Bibliography. ——

Oriental Catalogues of New and Second-Hand Books on Sale by Kegan Paul, Trench, Trübner & Co., Limited.—No. vii. Books on the Languages and Dialects spoken in British India and Ceylon, viz. Comparative Philology, Polyglots, etc. (pp. 40); No. viii. Books on the Great Oriental Religions (pp. 44); No. ix. Books on the Natural History and Medical Science of the East, and on the Agriculture and Industries of the Tropics (pp. 56); No. x. Books on African Philology (pp. 32); No. xi. Books for the study of the Languages of the Moslem World (pp. 48). Size 8½ × 6. *Presented by Messrs. Paul, Trübner & Co.*

Central Asia. *Norske G. Selsk. Aarb.* **9** (1898): 12–40. **Hedin.**

Genom Centralasia af dr. Sven Hedin.

Central Asia—Moghuls. **Elias and Ross.**

A History of the Moghuls of Central Asia, being the Tarikh-i-Rashidi of Mirza Muhammad Haidar, Dughlát. An English Version Edited, with Commentary, Notes, and Map by N. Elias. The Translation by E. Denison Ross. Re-issue with Portrait and Map. London: Low & Co., 1898. Size 9 × 6, pp. xxvi. and 536. *Price 10s. 6d. Presented by the Publishers.*

This is a re-issue with a coloured frontispiece from a portrait of Timur, and a map of Central Asia, showing the region the war-like history of which forms the subject of the book.

China. ——

Chambre de Commerce de Lyon. La Mission Lyonnaise d'exploration commerciale en Chine, 1895–1897. Lyon: A. Rey et Cie., 1898. Size 12 × 8½, pp. xxxvi., 386, and 470. *Maps and Illustrations. Presented by the Chamber of Commerce, Lyons.*

This splendid monument of French commercial enterprise contains a history of the commission sent out by the Chamber of Commerce of Lyons to China, an account of the journeys made from Tongking to Sechuan and thence to Canton, an article on the aboriginal races of South-Western China, and a series of special commercial reports on Tongking, Yunnan, Hongkong, Canton, Kwechau, Sechuan, and Hankau, together with separate reports on the chief commodities of China, completes the work.

China. *Oester. Monats. Orient* **24** (1898): 123–129. ——

Die Seidencultur in China.

China. **Bray.**

Fd. de Bray. La Chine et ses besoins au point de vue de l'utilisation des Belges, de leurs capitaux et de leur industrie. Louvain: Polleunis & Centerick, 1898. Size 9½ × 6½, pp. xvi. and 60. *Map. Price* 1*s.* 6*d.*

The map shows a scheme for a railway system for China.

China. *Imp. and Asiatic Quarterly Rev.* 7 (1899): 58–63. **Little.**

The Partition of China. By Archibald Little.

China. *Scottish G. Mag.* **14** (1898): 643–648. **Yate.**

The Journey from Shanghai to Peking and back. By Major A. C. Yate. *With Illustrations.*

This contains useful notes on the route to Peking by the railway from Tientsin, with hints for improving the passenger service of the steamers.

Chinese Empire—Mongolia. *Globus* **74** (1898): 319–322. **Zichy.**

Aus Urga in der Mongolei. Von Eugen Graf Zichy. *With Illustrations.*

The illustrations contain some striking Mongolian portraits, illustrating the national dress.

French Indo-China. *Annuaire Club Alpin Français* **23**, 1896 (1897): 446–495. **Salles.**

Une tournée en Indo-Chine, novembre 1895—Mai 1896. Par M. A. Salles. *With Illustrations.*

A journey from Saigon to Langson.

India—Chitral. **Duthie.**

The Botany of the Chitral Relief Expedition, 1895. By J. F. Duthie.—Records of the Botanical Survey of India. Volume i., No. 9. Calcutta, 1898. Size 10 × 6½, pp. 139–182. *Map.*

India—Himalayas. **Waddell.**

Among the Himalayas. By Major L. A. Waddell. London: A. Constable & Co., 1899. Size 9½ × 6½, pp. xvi. and 452. *Map and Illustrations. Price* 18*s. Presented by the Publishers.*

The richly illustrated narrative of a journey through Sikkim by an accomplished student of the Himalayan peoples.

Indo-China. *Ann. G.* **7** (1898): 457–462. ——

Travaux du Bureau topographique des troupes de l'Indo-Chine.

Malay Archipelago. ——

Revised Supplement, 1898, relating to the Eastern Archipelago. Part i., 1890. (Corrected to October 17, 1898.) London: J. D. Potter, 1898. Size 10 × 6, pp. 84. *Price* 9*d. Presented by the Hydrographic Office, Admiralty.*

Pamir Boundary Commission. **Gerard, Holdich, Wahab, and Alcock.**

Report on the Proceedings of the Pamir Boundary Commission. By Major-General M. G. Gerard, C.B., Colonel T. H. Holdich, C.B., Lieut.-Colonel R. A. Wahab, and Surgeon-Captain A. W. Alcock, 1896. Calcutta, 1897. Size 13½ × 9, pp. 100. *Maps and Illustrations. Presented by the India Office.*

This very interesting and finely illustrated Report was noticed in the *Journal* for January, p. 50.

Philippine Islands. **Worcester.**

The Philippine Islands and their People. A Record of Personal Observation and Experience, with a short summary of the more important facts in the History of the Archipelago. By Dean C. Worcester. New York: The Macmillan Co., 1898. Size 10 × 6½, pp. xx. and 530. *Maps and Illustrations. Price 15s. Presented by the Publishers.*

This will for a long time be the standard work on the Philippine islands. Mr. Dean had spent nearly a year in the islands in 1887–88, studying their zoology, and especially their bird-life, and, returning in 1890, spent a much longer time in visiting and studying the various islands. The zoological motives of the author in no way lead him to neglect the historical, geographical, economic, and social aspects of the archipelago, which since his journeys has become an American possession.

Russia—Caucasus, etc. **Zichy**

XV. u. XVI. Jahresb. (1896 *u.* 1897) *Württemberg. Ver. Handelsg.* (1898): 22–35.

Meine Reise im Kaukasus und Zentralasien zur Ermittelung der Ursitze der Völker mit besonderem Bezug auf den ungarischen Namen. Von Eugen Graf Zichy.

Russia—Siberia. *Ann. G.* 7 (1898): 351–362, 429–440. **Raveneau.**

Louis Raveneau. Travaux des Russes dans l'Asie Septentrionale. *Also separate copy. Presented by the Author.*

Russia—Trans-Caspian. **Boutroue.**

Annuaire Club Alpin Français 23, 1896 (1897): 414–445.

En Transcaspie. Par M. Alexandre Boutroue. *With Map and Illustrations.*

Russia—Trans-Caspian. *Petermanns M.* 44 (1898): 204–214. **Walther.**

Das Oxusproblem in historischer und geologischer Beleuchtung. Von Prof. Dr. Johannes Walther. *With Profile.*

Siam—Name. *Imp. and Asiatic Quarterly Rev.* 7 (1899): 162–164. **Gerini.**

Shan and Siam (A Few More Explanations). By Major G. E. Gerini.

Turkey. **Warkworth.**

Notes from a Diary in Asiatic Turkey. By Lord Warkworth, M.P. London: E. Arnold, 1898. Size 10 × 7½, pp. xvi. and 268. *Map and Illustrations. Price 21s. Presented by the Publisher.*

Lord Warkworth, now Earl Percy, has produced a superb record of his tour in Anatolia and Armenia, which took place in 1897–98. The book deals with the land and people from the standpoint of an English member of parliament, and is illustrated by a map of the route, and many beautifully reproduced and characteristic photographs. The journey was by rail from Scutari to Angora, thence to Samsun, by sea to Trebizond, and again by land to Erzerum, east to Alexandropol, and south by Bayazid and Van to Mosul, and thence through Diarbekir to Alexandretto.

AFRICA.

Algeria—Aurès Mountains. **Salomé.**

Annuaire Club Alpin Française 23, 1896 (1897): 577–585.

Une ascension dans l'Aurès: l'Amar-Kaddou. Par M. Th. Salomé.

These mountains rise to the east of Biskra.

Algeria, Kabylia. *Annuaire Club Alpine Français,* 24 (1897) (1898): 297–331. **Tabary.**

Huit jours en Kabylie, flanc Nord du Djurjura. Le Tamgout de Lalla Khedidja. Par M. C. Tabary. *With Illustrations.*

Angola. *B.S. d'Études colon.* 5 (1898): 233–269. **Ivens.**

L'Angola méridional. Par Ch. Ivens.

An account of the country and the resources of southern Angola by a former Belgian Consul at Mossamedes.

Angola. *Kolonial Jahrb.* 11 (1898): 15–32. **Löser.**

Angola unter portugiesischer Herrschaft. Von Reinhard Löser.

A pessimistic account of the condition of Portuguese West Africa.

British Central Africa. ———

Africa, No. 9 (1898). Annual Report on the British Central Africa Protectorate for the year 1897–98. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. 30. *Price 3d.*

British East Africa. *M.G. Ges. Wien* 41 (1898): 531–534. **Paulitschke.**

Begleitwort zur Karte der Graf Eduard Wickenburg's Reiserouten in Britisch-Ost-Afrika 1897 und 1898. Von Prof. Dr. Ph. Paulitschke. *With Map.*

British East Africa—Uganda. *Norske G. Selsk. Aarb.* 9 (1898): 168–195. **Skattum.**

Nilens kilder af skolebestyrer. C. J. Skattum.

A discussion of the history of the search for the sources of the Nile from the earliest times to the present.

British West Africa—Gold Coast. **Smith.**

Gold Coast. Annual Report for 1897. Colonial Reports, Annual No. 249, 1898. Size 10 × 6½, pp. 28. *Price 2d.*

This report contains the monthly rainfall for six stations.

British West Africa—Sierra Leone. **Edwards.**

The French and Sierra Leone. By F. A. Edwards. (From the *Gentleman's Magazine,* November, 1898, pp. 449–469.) *Map. Presented by the Author.*

Canary Islands—Teneriffe. **De Windt.**

Morphométrie de Ténériffe. Par Jean De Windt. Bruxelles, 1898. Size 9 × 6, pp. [10]. *Map. Presented by the Author.*

Measurements of the mean height and average slope of Tenerife from a contoured map.

Central Africa—Tanganyika. *Fortnightly Rev.* 65 (1899): 25–33. **Decle.**

The Tanganyika Railway. By Lionel Decle.

Congo State. **Cornet.**

L'age de la Pierre dans le Congo occidental. Communication faite à la Société d'Anthropologie de Bruxelles, dans la séance du 30 novembre 1896. Par M. J. Cornet.—Extrait du Bulletin de la Société d'Anthropologie de Bruxelles. Tome xv., 1896-1897. Bruxelles, 1897. Size 10 × 6½, pp. 8. *Plates. Presented by the Author.*

Description of palæolithic implements from the Congo State.

Congo State. *Norske G. Selsk. Aarb.* 9 (1898): 41–55. **Sundt.**

Fra Kongo. Af Kaptein Fr. Sundt.

Congo State. **Thonner.**

Im Afrikanischen Urwald. Meine Reise nach dem Kongo und der Mongalla im Jahre 1896. Von Franz Thonner. Berlin: D. Reimer (Ernst Vohsen), 1898. Size 10½ × 7, pp. x. and 116. *Portrait, Maps, and Illustrations. Price 10s. 6d.*

This record of a journey up the Mongallo river is illustrated by a fine set of 86 full-page photographs and three maps.

Congo State. *Ann. G.* 7 (1898): 462–466. **Lorin.**

Le chemin de fer du Congo. Par M. Henri Lorin.

Congo State. *Mouvement G.* 15 (1898): 586–589. **Wauters.**

Notre carte de l'État Independant du Congo au 2,000,000e. Feuille X: La région des Sources du Congo, le Katanga et le bassin du Bangweolo. Par A. J. Wauters. *With Map.*

East Africa—Bòttego's Second Expedition. **Vannutelli and Citerni.**
B.S.G. Italiana 10 (1897): 320–330.

Relazione preliminare sui risultati geografici della seconda spedizione condotta dal capitano Vittorio Bòttego nell' Africa orientale di L. Vannutelli e C. Citerni. *With Map.*

Egyptian Sudan. *B. Comité l'Afrique Française* 8 (1898): 367-370. ———

Dans le Bahr-el-Ghazal: L'occupation de Dem-Ziber.

This paper is illustrated by a facsimile of General Gordon's manuscript map.

French Guinea. *A travers le Monde, Tour du Monde* 4 (1898): 369–372. **Piquerez.**

La Guinée Française. Par M. Charles Piquerez. *With Illustrations.*

French Guinea. *Annuaire Club Alpin Français* 23, 1896 (1897): 496–506. **Salesses.**

Une ascension au Kakoulima, Guinée française. Par M. le capitaine E. Salesses. *With Map.*

The mountain, which rises on the coast of French Guinea, north-west of Konakry, was ascended to the height of about 3000 feet, its total height being estimated at about 3400 feet.

French West Africa. **Castellani.**

Ch. Castellani. Vers le Nil Français avec la Mission Marchand. Paris: E. Flammarion [1898]. Size 9 × 6, pp. 438. *Illustrations. Price 8s. 6d.*

Description by an artist of the first stage of the Marchand expedition on the Mobangi.

German South-West Africa. **Rehbock.**

Deutsch-Südwest-Afrika. Seine wirtschaftliche Erschliessung unter besonderer Berücksichtigung der Nutzbarmachung des Wassers. Bericht über das Ergebnis einer im Auftrage des "Syndikates für Bewässerungsanlagen in Deutsch-Südwest-Afrika" durch das Herero- und Gross-Namaland unternommenen Reise von Th. Rehbock. Berlin: D. Reimer (Ernst Vohsen), 1898. Size 11 × 7½, pp. xxii. and 238. *Maps and Illustrations. Price 14s. Presented by the Publisher.*

The author went out to German South-West Africa on behalf of a syndicate for establishing irrigation works. He describes his expèditions in Hereroland and Namaland, discusses the existing geographical and economic conditions, and deals in great detail with the question of water-supply and irrigation.

German West Africa—Kamerun. **Plehn.**

Die Kamerun-Küste. Studien zur Klimatologie, Physiologie und Pathologie in den Tropen. Von Dr. Friedrich Plehn. Berlin: A. Hirschwald, 1898. Size 10 × 6½, pp. vi. and 364. *Map and Diagrams.*

On the hygienic conditions of the Kamerun coast considered in relation to climate and specific diseases.

Mauritius. **Bruce.**

Mauritius and Rodrigues. Annual Reports for 1897. Colonial Reports, Annual No. 250, 1898. Size 10 × 6½, pp. 42. *Price 2½d.*

Portuguese East Africa—Limpopo. *B.S.G. Lisboa* **16** (1897): 561–568. ——

Esboço hydrographico do Limpopo. Memoria descriptiva. *With Map.*

The map is on a very large scale, and shows the soundings of the river Limpopo taken by an armed launch.

Sokotra. *Scottish G. Mag.* **14** (1898): 629-636. **Bent.**

The Island of Sokotra. By Mrs. Theodore Bent.

A paper read at the meeting of the British Association at Bristol.

Somaliland. *B.S.G. Italiana* **10** (1897): 257–264, 309–313. ——

Comunicazioni della Presidenza. Spedizione Bòttego.

Sudan. *B. Comité l'Afrique Française* **8** (1898): 363–367. ——

La mission Marchand.

Sudan. *B. Comité l'Afrique Française* **8** (1898): 325–332. **Liotard and Marchand.**

De l'Oubangui au Nil: Les missions Liotard et Marchand.

Sudan. **Edwards.**

How the Sudan was conquered. By F. A. Edwards. (From the *Westminster Review*, December, 1898, pp. 609–617.) Size 10 × 6½. *Presented by the Author.*

West Africa. *Petermanns M.* **44** (1898): 193–204. **Frobenius.**

Der westafrikanische Kulturkreis. Von L. Frobenius. *With Maps.*

NORTH AMERICA.

Canada—Ethnological Survey. ——

An Ethnological Survey of Canada.—Second Report of the Committee. Size 8½ × 5½, pp. 18. *Presented by C. Hill-Tout, Esq.*

Mexico. *P.A. Nat. Sci. Philadelphia* (1898): 372–413. **Harshberger.**

Botanical Observations on the Mexican Flora, especially on the Flora of the Valley of Mexico. By John W. Harshberger, PH.D.

Newfoundland. *Nineteenth Century* **45** (1899): 46–55. **McGrath.**

France in Newfoundland. By P. T. McGrath.

Niagara Falls. *American J. Sci.* **6** (1898): 439–450. **Spencer.**

Another Episode in the History of Niagara Falls. By J. W. Spencer. *With Map and Section.*

United States—Arizona. **Franklin.**
Report of the Governor of Arizona.—Annual Report of the Secretary of the Interior, 1896. Vol. iii. pp. 207–346. *Map and Illustrations.*

An elaborate and well-illustrated description of the territory of Arizona.

United States—Hydrographic Office. *Nautical Mag.* 67 (1898): 414–423. **Allingham.**
The United States Hydrographic Office. By W. Allingham.

United States—Minnesota. *American J. Sci.* 6 (1898): 469–477. **Todd.**
A Revision of the Moraines of Minnesota. By J. E. Todd. *With Map.*

United States—Missouri and South Dakota. **Owen.**
Cave Regions of the Ozarks and Black Hills. By Luella Agnes Owen. Cincinnati: The Editor Publishing Co., 1898. Size 7½ × 5½, pp. 228. *Plans and Illustrations. Presented by the Publishers.*

An interesting account of the great caverns of South Dakota and Missouri, with striking photographs of the stalactitic chambers.

United States—New Mexico. **Thornton.**
Report of the Governor of New Mexico.—Annual Report of the Secretary of the Interior, 1896. Vol. iii. pp. 347–419.

United States—Kansas. *T.A. Sci. St. Louis* 8 (1898): 55–70. **Hitchcock.**
Ecological Plant Geography of Kansas. By A. S. Hitchcock.

The word *Ecological* is not explained. The plants are considered with regard to habitat—*e.g.* water, swamps, desert, rocks, etc.

CENTRAL AND SOUTH AMERICA.

Argentine and Chile. **Varela.**
Luis V. Varela. En la Cordillera Andina. Contribución al estudio histórico-juridico de los tratados y protocolos celebrados entre la República Argentina y Chile, 1843–1898. Seguido de un Apéndice con el texto integro de los tratados, protocolos y actas correspondientes. Buenos Aires, 1898. Size 8 × 5½, pp. 150. *Presented by the Author.*

Argentine Republic. **Figueroa.**
Ministerio de obras Publicas de la Provincia de Buenos Aires. Estudios sobre Puertos en la Provincia de Buenos Aires. Primera Parte. La Costa Maritima. Informe presentado al Departamento de Ingenieros por el Jefe de la Comisión Encargada de los Estudios Ingº. Julio B. Figueroa. Text and Atlas. La Plata, 1897. Size (Text) 11½ × 7½, (Atlas) 14½ × 11½, pp. liv. and 400. *Presented by the Author.*

Brazil—Bahia. *Rev. Trim. I. G. e Hist. Bahia* 5 (1898): 437–450. **Souza.**
As Riquezas naturaes do Estado da Bahia, pelo Capitão-tenente Collatino Marques de Souza.

On the natural resources of the State of Bahia.

Chile. *M.G. Ges. Jena* 17 (1898): 1–23. **Martin.**
Der Calbuco und andere Vulkane des südlichen Chile. Von Dr. Carl Martin.

Chile—Western Patagonia. **Steffen.**
Viajes i Estudios en la rejion hidrográfica del Rio Puelo (Patagonia Occidental). Por Dr. Juan Steffen. Santiago de Chile: Imp. Cervantes, 1898. Size 9½ × 6½, pp. 176. *Maps and Illustrations. Presented by the Author.*

Dr. Steffen's description of the Chilian survey expedition to the region of the Argentine boundary is followed by three appendices—on the botanical geography of the Rio Manso region, by Dr. Krüger; the petrology of the rocks collected during the expedition, by Dr. Pöhlmann; and the observations of latitude and altitude made by Dr. Krüger.

Cuba—Archæology. **Brinton.**
The Archæology of Cuba. By Daniel G. Brinton, M.D. (Reprinted from *American Archæologist*, Columbus, O., vol. 2. No. 10. October, 1898.) Size 9½ × 6½. pp. 4. *Presented by the Author.*

Falkland Islands—Marine Fauna. **Pratt.**
Mem. and P. Manchester Lit and Philosoph. S. 42 (1898): 1–26.

Contributions to our Knowledge of the Marine Fauna of the Falkland Islands. By Edith M. Pratt. *With Plate.*

Peru—Railways. **Figueroa.**

Julio B. Figueroa. La vía interoceánica central del Perú. (Artículo publicado en los "Anales de la Sociedad Cientifica Argentina," tomo xlv., páginas 209 y siguientes.) Buenos Aires, 1898. Size 10 × 6½, pp. 30. *Profile. Presented by the Author.*

On the projected trans-Andine railway to connect Callao *viâ* Oroya with the navigable tributaries of the Amazon.

Trinidad. **Stark.**

Stark's Guide-Book and History of Trinidad, including Tobago, Granada, and St. Vincent; also a trip up the Orinoco, and a description of the great Venezuelan Pitch Lake, containing a description of everything relating to these places that would be of interest to Tourists and Residents. By James H. Stark. Boston: J. H. Stark; London: Low & Co. 1897. Size 8 × 5½, pp. x. and 170. *Maps and Illustrations. Price* 6*s.*

West Indies. **Hill.**

Cuba and Porto Rico, with the other Islands of the West Indies. Their Topography, Climate, Flora, Products, Industries, Cities, People, Political Conditions, etc. By Robert T. Hill. London: T. Fisher Unwin, 1898. Size 9½ × 6½, pp. xxviii. and 430. *Maps and Illustrations. Price* 16*s. Presented by the Publisher.*

This is a solid and valuable contribution to the scientific knowledge of the West Indies, dealing first with the geography and natural conditions of the West Indies as a whole, and then discussing each of the larger islands in detail. While the special interest of the book at present lies in the description of the rich islands occupied by the United States army, the other members of the archipelago are also adequately and authoritatively described.

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Semon.**

In the Australian Bush and on the Coast of the Coral Sea. Being the experiences and observations of a Naturalist in Australia, New Guinea, and the Moluccas. By Richard Semon. London: Macmillan & Co., 1899. Size 10½ × 7, pp. xvi. and 552. *Maps and Illustrations. Price* 21*s. Presented by the Publishers.*

The admirable character of Prof. Semon's popular account of his travels and study of the natural history of Australasia was pointed out when noticing the German edition, and it is satisfactory to find that this interesting work has been presented in an English dress.

Australasia—Tide-tables. **Goalen.**

Tables for finding approximately the Time and Height of High Water at the principal ports in New Zealand (Auckland, Wellington, Lyttleton, Port Chalmers); also at Sydney, New South Wales, and Hobart, Tasmania. By Captain W. N. Goalen. London: J. D. Potter, 1898. Size 10 × 6½, pp. 24. *Price* 8*d.*

Australian Aborigines. **Spencer and Gillen.**

The Native Tribes of Central Australia. By Baldwin Spencer, M.A., and F. J. Gillen. London: Macmillan & Co., 1899. Size 9½ × 6, pp. xx. and 672. *Maps and Illustrations. Price* 21*s. Presented by the Publishers.*

This is an exhaustive anthropological treatise illustrated by photographs of the various rites and implements described. Mr. Gillen, as the "special magistrate and sub-protector of aborigines" at Alice Springs in South Australia, was for nearly twenty years closely concerned with native tribes, and both authors are regarded as fully initiated members of one of the tribes. The complex questions of native relationships and the totemic system are gone into more fully and with more perfect data than ever before, and due care is taken to keep separate the record of observed facts and the theoretical conclusions to which their discussion tends. Two maps are given, showing the tracks and camping-places of two of the Central Australian tribes.

British Solomon Islands. **Woodford.**

British Solomon Islands. Annual Report for 1897–8. Colonial Reports, Annual No. 251, 1898. Size 10 × 6½, pp. 16. *Price* 1*d.*

German New Guinea. *Kolon. Jahrb.* 11 (1898): 1-14. **Dempwolff.**

Die Erziehung der Papuas zu Arbeitern. Von Dr. Otto Dempwolff.

On the people of German New Guinea, and the way in which they may best be trained to work.

German New Guinea. *Petermanns M.* 44 (1898): 275–276. **Langhans.**
Beiträge zur Kenntnis der deutschen Schutzgebiete. Von Paul Langhans. Nr. 12A: Karawarra in der Neu-Lauenburg-Gruppe. Nr. 12B: Enüwetok oder Brown-Inseln. *With Maps.*

Hawaii. *P.A. Nat. Sci. Philadelphia* (1898): 203–205. **Sharp.**
Rock Inscriptions in Kauai, Hawaiian Islands. By Dr. Benjamin Sharp.

New South Wales. ———
Annual Report of the Department of Mines and Agriculture, New South Wales, for the year 1897. Sydney, 1898. Size 13 × 8½, pp. 216. *Plans.*

New South Wales. ———
New South Wales. Report of the Department of Public Works, for the year ended 30th June, 1897. Sydney, 1898. Size 13½ × 8½. pp. 118. *Maps and Illustrations. Presented by the Agent-General for New South Wales.*

Reports and maps of the railways, roads, harbour-improvements and other public works of the colony, including a large-scale map of the sewerage of Sydney.

New South Wales. ———
New South Wales. Eighteenth Annual Report of the Department of Lands, being for the year 1897. Sydney, 1898. Size 13 × 8½, pp. iv. and 120. *Maps. Presented by the Agent-General for New South Wales.*

With numerous maps showing the transactions in public lands, the position of the great lines of rabbit-proof fencing in New South Wales, and other matters. (See p. 307.)

New Zealand. **Kronecker.**
Wanderungen in den Südlichen Alpen Neu-Seelands mit zahlreichen nach original Photographien hergestellten Abbildungen von Dr. med. Franz Kronecker. Berlin: Max Pasch, 1898. Size 10 × 6½, pp. 120. *Map and Illustrations. Presented by the Author.*

Record of a mountaineering trip in New Zealand, by a member of the German Alpine Club.

New Zealand. **Reeves.**
The Long White Cloud. Ao Tea Roa. By William Pember Reeves. London: Horace Marshall & Son, 1898. Size 8½ × 6, pp. xiv. and 430. *Map and Illustrations. Price 6s. Presented by the Publishers.*

The Agent-General for New Zealand has here produced an attractive history of the colony he represents, in which the characteristics of Maori and colonist are sympathetically treated as a clue to the incidents of the early troubles and present prosperity of the islands.

Polynesia. *Globus* 74 (1898): 313–315. **Thilenius.**
Nordwest-Polynesier. Von Dr. G. Thilenius.

The article includes an account of a landing on Stewart island in 8° 24′ S. and 163° 2′ E., and a comparison between the people and language of the atoll with those of other Polynesian groups. The author comments on the confusion caused by the number of islands to which the names of Stewart, Lord Howe, Sandwich, etc., are applied in the Pacific.

Queensland. **Jack.**
Queensland Department of Mines, Geological Survey. Bulletin No. 9. Report to the Honourable the Minister for Mines on the Chillagoe Mining District and Projected Railway. By Robert L. Jack. Brisbane, 1898. Size 9 × 6, pp. 22. *Map. Presented by the Author.*

Samoa. *Fortnightly Rev.* 65 (1899): 54–73. **Leigh.**
The Powers and Samoa. By John George Leigh.

South Australia. *Deutsche G. Blätter* 21 (1898): 162–166. **Greffrath.**
Das australische Nordterritorium. Von Henry Greffrath.

Western Australia. **Carnegie.**
Spinifex and Sand. A Narrative of Five Years' Pioneering and Exploration in Western Australia. By the Hon. David W. Carnegie. London: C. Arthur Pearson, Limited, 1898. Size 9 × 6, pp. xvi. and 454. *Portrait, Maps, and Illustrations. Price 21s. Presented by the Publisher.*

A full narrative of the author's travels for five years on the gold-fields and in the far interior of Western Australia, illustrated by good maps and interesting photographs and sketches. The geographical results were summarised in the paper read by Mr. Carnegie to the Royal Geographical Society, and published in the *Journal*, vol. xi. p. 258.

Western Australia. *J. R. Colonial I.* **30** (1898): 9–29. **Wittenoom.**
Western Australia in 1898. By the Hon. E. H. Wittenoom.

The article deals with climate, land, goldfields and general resources. Attention is called to the fact that a steamer of 10,000 tons recently entered Fremantle harbour, which is being deepened to render it available for easy use by the largest passenger vessels.

Western Australia—Year-Book. **Fraser.**
Western Australian Year-Book for 1896–97. (Tenth Edition.) By Malcolm A. C. Fraser. Perth, 1898. Size 8½ × 5½, pp. xvi. and 580. *Maps. Presented by the Registrar-General of Western Australia.*
Another copy. *Presented by the Author.*

POLAR REGIONS.

Antarctic. *Norske G. Selsk Aarb.* **9** (1898): 153–156. **Borchgrevink.**
Den antarctiske expedition (uddrag) af C. E. Borchgrevink.

The plan of the cruise of the Southern Cross.

Antarctic. *Nautical Mag.* **67** (1898): 833–836. **Caborne.**
Antarctic Exploration. By Commander W. F. Caborne.

Antarctic. *Riv. G. Italiana*, **5** (1898): 519–532. **Gribaudi.**
Verso il Polo Sud del Dottor Pietro Gribaudi.

A summary of recent projects for antarctic exploration.

Arctic—Spitsbergen. *Ymer* **18** (1898): 235–242. **Nathorst.**
Om Spaningarne efter Andrée kring Spetsbergen och vid Franz Josefs Land. Af A. G. Nathorst.

On the voyage in search of traces of Andrée round Spitsbergen and to Franz Josef Land.

MATHEMATICAL GEOGRAPHY.

Determination of Heights. *Riv. G. Italiana* **5** (1898): 457–464. **Bittanti.**
La determinazione delle altitudini presso gli antichi di Ernesta Bittanti.

On the methods of finding heights used in ancient times.

Geodesy. *Science* **8** (1898): 841–847. **Preston.**
The General Conference of the International Geodetic Association at Stuttgart, October 3–12, 1898. By E. D. Preston.

Great Globe. *Deutsche G. Blätter* **21** (1898): 151–161. **Reclus.**
Ein grosser Globus. Vortrag von Prof. Elisée Reclus.

Longitude Determinations. *C.Rd.* **127** (1898): 935–938. **Bigourdan.**
Sur la prédiction des occultations d'étoiles par la Lune, et sur le calcul des longitudes terrestres au moyen des occultations. Mémoire de M. G. Bigourdan.

Latitude. *C. Rd.* **127** (1898): 801–804. **Renan, Perchot, and Ebert.**
Sur la détermination de la latitude de l'Observatoire de Paris, par les méthodes de M. Lœwy. Note de MM. H. Renan, J. Perchot, et W. Ebert.

M. Lœwy's method is to observe a star very near the pole in nearly symmetrical positions with regard to the hour circles of 6h. or 18h., and overcoming the want of perfect symmetry by a calculation derived by a simple formula from two observed instrumental co-ordinates.

Map Projections. *Riv. G. Italiana* **5** (1898): 437–456, 501–518. **Venturi.**
Sopra alcune proprietà rappresentative degli angoli e sulla proiezione isodromica. Nota del Prof. A. Venturi.

Nautical Tables. ———
Navigation Tables. Published by the Chief of the Hydrographic Department, Ministry of Marine, 1897. 7th edition. [In Russian.] St. Petersburg, 1897. Size 10 × 6½, pp. 134 and 342.

Navigation. *Nautical Mag.* **67** (1898): 188–192. **Johnson.**
Great Circle Sailing made easy. By A. C. Johnson.

Surveying. **Blim and Rollet de l'Isle.**

Manuel de l'Explorateur, procédés de levers rapides et de détail; détermination astronomique des positions géographiques. Par E. Blim et M. Rollet de l'Isle. Paris: Gauthier-Villars, 1899 [1898]. Size 7½ × 5, pp. viii. and 260.

Instructions in surveying for travellers.

Tides. *National G. Mag.* 9 (1898): 465–475. **Jefferson.**

What is the Tide of the open Atlantic? By Mark S. W. Jefferson.

Tides. *J.R. United Service I.* 42 (1898): 1378–1413. **Moxly.**

A suggested correction of the accepted theory of the Tides. By the Rev. J. H. S. Moxly.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Marr.**

The Principles of Stratigraphical Geology. By J. E. Marr. Cambridge: The University Press, 1898. Size 7½ × 5, pp. 304. *Illustrations. Price 6s. Presented by the Publishers.*

A remarkably clear exposition of the essential facts of stratigraphical geology without the use of technical language. This is exactly the sort of book for a student of physical geography to study, in order to obtain a working knowledge of the order of the rocks and the meaning and value of geological maps.

Geomorphology. *Scottish G. Mag.* 14 (1898): 649–654. **Suess.**

On the Asymmetry of the Northern Hemisphere.

A summary of a lecture by Prof. Suess, in which he calls attention to many interesting and puzzling features in the terrestrial relief of the northern hemisphere.

Geomorphology. **Geikie.**

Earth Sculpture, or the Origin of Land-Forms. By James Geikie, LL.D., etc. London: John Murray, 1898. Size 9 × 6, pp. xvi. and 320. *Illustrations. Price 6s. Presented by the Publisher.*

This is the first English book dealing systematically with the classification and origin of land-forms, epitomising the contribution of geology to the science of geography. The classes of land-forms are arranged according to the arrangement of the strata, *i.e.* in regions of horizontal, gently inclined, folded, disturbed, or faulted strata, and with regard to igneous, glacial, and æolian and aqueous action. Chapters are devoted to basins, coast-lines, and to the classification of land-forms. A glossary of technical terms and an index adapt the book for ready reference. (See p. 308.)

Meteorology—Temperature. **Rubenson.**

K. Svensk. Vetens.-A. Handlingar 30 (1898): 1–85.

Études sur diverses méthodes servant à calculer la moyenne diurne de la température à l'aide des observations faites aux heures adoptées dans les stations météorologiques suédoises. Par R. Rubenson.

Oceanic Life. *K. Svensk. Vetens.-A. Handlingar* 30 (1898): 1–426. **Aurivillius.**

Vergleichende thiergeographische Untersuchungen über die Plankton-Fauna des Skageraks in den Jahren 1893–1897. Von Carl W. S. Aurivillius.

Oceanography. **De Windt.**

Sur les distances moyennes à la Côte dans les Océans. Par Jean de Windt. Bruxelles, 1898. Size 11½ × 9½, pp. 14. *Maps. Presented by the Author.*

A calculation of the positions of lines on the ocean surface equidistant from the nearest land.

Oceanography. *Scottish G. Mag.* 14 (1898): 636–642. **Natterer.**

Oceanographical Results of the Austro-Hungarian Deep-sea Expeditions. By Dr. K. Natterer.

A paper read at the Bristol meeting of the British Association.

Oceanography and Climate. *Ymer* 18 (1898): 243–253. **Pettersson.**

Om Atlantiska oceanens inflytande på vårt vinterklimat. II. Af Otto Pettersson. *With Diagrams.*

On the influence of the Atlantic ocean on the winter climate of Sweden.

Oceanography—Temperature. *Petermanns M.* 44 (1898): 258–259. **Köppen.**

Temperatur-Anomalie der Meeresoberfläche. Nach Prof. Dr. W. Köppen. *With Map.*

The object of this map—which has already appeared in the *Annalen für Hydrographie*—is to show the regions where the temperature of the surface water is high or low, relatively to the normal temperature of the latitude.

Physical Geography. **Dawkins and Hobson.**

The Owens College, Manchester. Physical Geography Lectures, by Prof. Boyd Dawkins and Bernard Hobson. References to Literature of the Subject. Size 7½ × 5, pp. 24. *Presented by Bernard Hobson, Esq., M.Sc.*

A classified list of books and papers on the various departments of physical geography.

Phyto-Geography. *T.A. Sci. St. Louis* **8** (1898): 25–41. **Schrenk.**

The Trees of St. Louis as influenced by the Tornado of 1896. By Hermann von Schrenk. *With Plates.*

A study of the wood of trees killed or injured during the passage of a tornado.

River Development. **Russell.**

River Development as illustrated by the Rivers of North America. By Prof. I. C. Russell. London: John Murray, 1898. Size 8½ × 6, pp. xvi. and 328. *Illustrations. Price* 6*s. Presented by the Publisher.*

Valley-formation. *Ann. G.* **7** (1898): 385–403. **Martonne.**

Problèmes de l'histoire des vallées. Enns-Salzach. Par M. E. de Martonne.

This article deals with the geographical history of the valleys of the Enns-Salzach system as a contribution to the study of the relation of river-systems to the land.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial Geography. **Cornewall-Jones.**

The British Merchant Service, being a History of the British Mercantile Marine from the Earliest Times to the Present Day. By R. J. Cornewall-Jones. London: Low & Co., 1898. Size 9 × 6, pp. xviii. and 406. *Illustrations. Presented by the Publishers.*

A history of British merchant shipping, with descriptions and pictures of all types of trading vessels from the earliest down to the present day, and additional chapters on lighthouses, light-ships, flags, and other matters affecting the mercantile marine.

Commercial Geography. *B.S.G. Lisboa* **16** (1897): 503–549. **Rozenraad.**

A lucta commercial das Nações. Conferencia realisada no Instituto dos Banqueiros de Londres em 2 de Fevereiro de 1898 por C. Rozenraad. Traducção do Inglez de M. da Motta.

Commercial Geography—Fibres. ———

Royal Gardens, Kew. Bulletin of Miscellaneous Information. Additional Series, II. Selected Papers from the Kew Bulletin. I.—Vegetable Fibres. London: Eyre & Spottiswoode, 1898. Size 9½ × 6, pp. 280. *Price* 3*s.* 6*d. Presented by the Director, Royal Gardens, Kew.*

A collection of eighty-nine articles dealing with a large number of different vegetable fibres produced in all parts of the world.

Historical—Vasco da Gama. *B.S.G. Lisboa* **16** (1897): 551–559. **Tomaschek.**

A viagem de Vasco da Gama (1497–1499). Conferencia do Professor Dr. Wilhelm Tomaschek na sessão solemne commemorativa em Vienna de Austria.

Historical—Vasco da Gama. ———

Cuarto Centenario del descubrimiento del camino marítimo para la India por Vasco de Gama. Mexico, 1898. Size 9 × 6½, pp. 70.

Historical—Vasco da Gama. *Norske G. Selsk. Aarb.* **9** (1898): 157–167. **Storm.**

Portugisernes opdagelse af søveien til Indien af Prof. Dr. Gustav Storm. *With Map and Portrait.*

Life at High Altitudes. **Mosso.**

Life of Man on the High Alps. By Angelo Mosso. Translated from the Second Edition of the Italian. By E. Lough Kiesow. London: T. Fisher Unwin, 1898. Size 10 × 6½, pp. xvi. and 342. *Illustrations. Price* 21*s. Presented by the Publisher.*

A record of the careful study of the physiological effects of exertion at high altitudes, carried out by Dr. Mosso on an extensive scale with the men of the Italian regiment stationed on the Alpine frontier, with additional information from other quarters. The discussion is a solid contribution to the question of the action of the rarefied air at high altitudes on climbers.

BIOGRAPHY.

Biographical Dictionary. **Lee.**

Dictionary of National Biography. Edited by Sidney Lee. Vol. lvi. Teach—Tollet; vol. lvii., Tom—Tytler. London: Smith, Elder, & Co., 1898–99. Size 10 × 6½, pp. (vol. lvi.) vi. and 454; (vol. lvii.) vi. and 462. *Price each vol.* 15*s.*

The following names of geographical interest appear among the notices in these volumes: Vol. lvi., Sir James Emerson Tennent, by G. C. Boase; Thomas Thompson, by E. Irving Carlyle; Sir Charles Wyville Thomson, by Rev. Prof. Bonney; Joseph Thomson, by H. A. Webster; Thomas Thomson, by B. B. Woodward; Robert Thorne, by C. Raymond Beazley; and Henry Timberlake, by Miss C. Fell Smith. Vol. lvii., William Towerson, by C. Raymond Beazley; Robert Townson, by E. Irving Carlyle; John Thomas Towson, by C. W. Sutton; James Kingston Tuckey, by Prof. J. K. Laughton; John Turnbull, by E. Irving Carlyle; and Samuel Turner, by Stephen Wheeler.

Chaix. **Kuhne.**

M. Paul Chaix. Par E. Kuhne. *With Portrait.* From *La Patrie Suisse*, No. 133. Genève, 26 Octobre, 1898. Pp. 253–254. Size 12 × 9.

Prof. Paul Chaix, a Corresponding Member of the Royal Geographical Society, has recently celebrated his ninetieth birthday amidst the congratulations of his fellow-geographers in Switzerland.

Fitzroy. *Symons's Monthly Meteorolog. Mag.* 33 (1898): 161–164. ———

Dealing mainly with Admiral Robert Fitzroy's services to meteorology.

GENERAL.

Almanac. ———

Annuaire pour l'An 1899, publié par le Bureau des Longitudes. Avec des Notices scientifiques. Paris: Gauthier-Villars. Size 6 × 4, pp. [772].

Almanac. **Olsen.**

The Fisherman's Nautical Almanack and Tide Tables. 1899. By O. T. Olsen. London: J. D. Potter. Size 7½ × 5, pp. 452. *Plan. Price* 1*s. Presented by the Compiler.*

Bibliography. ———

The English Catalogue of Books for 1897. London: Low & Co., 1898. Size 10 × 6½, pp. 236. *Price* 5*s.*

Bibliography. **Baschin.**

Bibliotheca Geographica, herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band IV. Jahrgang, 1895. Berlin: W. H. Kühl, 1898. Size 9 × 6, pp. xvi. and 412.

The volume for 1895 is even fuller and more satisfactory than its predecessors. A slight rectification in the arrangement, by which Commercial Geography is classed under Anthropogeography, is a distinct improvement. The accuracy of the printing of foreign titles is remarkable, and the exhaustiveness of the work leaves nothing to wish for.

British Empire. ———

Statistical Abstract for the several Colonial and other Possessions of the United Kingdom, in each year from 1883 to 1897. London: Eyre & Spottiswoode, 1898. Size 10 × 6½, pp. 300. *Price* 1*s.* 3*d.*

British Empire. ———

Colonial Import Duties. Return relating to the Rates of Import Duties levied upon the Produce and Manufactures of the United Kingdom, etc., in the Principal Colonial and other Possessions of the United Kingdom. London: Eyre & Spottiswoode, 1897. Size 10 × 6½, pp. viii. and 400. *Price* 1*s.* 8*d.*

Educational. ———

Education Department. Special Reports on Educational Subjects. Vols. 2 and 3. London: Eyre & Spottiswoode, 1898. Size 10 × 6½, pp. (vol. 2) viii. and 694; (vol. 3) vi. and 698. *Illustrations, Map, and Diagrams. Price* (vol. 2) 6*s.* 2*d.*; (vol. 3) 3*s.* 3*d.*

Although none of the articles deals specially with geography, several bear on its teaching, including descriptions of educational museums, and of the Royal Geographical Society's collection now in the keeping of the Teachers' Guild.

Educational—Methods. *Riv. G. Italiana* 5 (1898): 465–480. **Andreini.**

Sul materiale scolastico per l'insegnamento della Geografia e più specialmente sui plastici topografici. Considerazioni ed appunti del Dott. Angelo L. Andreini.

Health. *P.R.S.* 64 (1898): 100–118. **Kanthack, Durham, and Blanford.**

On Nagana, or Tsetse Fly Disease. (Report, made to the Tsetse Fly Committee of the Royal Society, of Observations and Experiments carried out from November, 1896, to August, 1898.) By A. A. Kanthack, H. E. Durham, and W. F. H. Blanford.

Ice Age. **Taber.**

The Ice Age, Past and Coming. By C. A. M. Taber. Boston: G. H. Ellis, 1898. Size 8 × 5½, pp. 102. *Charts. Presented by the Author.*

The author, who for many years was a South Sea whaler, lays stress on the great importance of oceanic currents and the circulation to which they give rise in influencing the temperature of the Earth's surface. He attributes the coldness of deep oceanic water to indraughts from the antarctic regions, where refrigeration has room to have its full effect, on account of the westerly winds keeping up an east-to-west current round the world, and so cutting off direct tropical surface currents from the antarctic sea.

Indian Ocean. **Findlay.**

A Directory for the Navigation of the Indian Ocean, with descriptions of its Coasts, Islands, etc., from the Cape of Good Hope to the Strait of Sunda and Western Australia, including also the Red Sea and the Persian Gulf, the Winds, Monsoons, and Currents, and the Passages from Europe to its various ports. Fourth Edition (1882). With Addenda, 1897. By Alexander George Findlay. London: R. H. Laurie. Size 10 × 6½, pp. xxxviii. and 1304; Addenda, 170. *Charts, etc. Price* 28*s*. *Presented by the Publisher.*

The 170 pages of addenda take account of all important changes in the body of the work, the valuable character of which is so well known.

Meteorites. **Fletcher.**

British Museum (Natural History). Mineral Department. An Introduction to the Study of Meteorites, with a list of the Meteorites represented in the collection. By L. Fletcher. Printed by order of the Trustees, 1896. Size 8½ × 5½, pp. 98. *Plan. Presented by the Trustees of the British Museum.*

South Atlantic Ocean. **Kettle.**

A Supplement to the Ninth Edition of Findlay's Sailing Directory for the South Atlantic Ocean, including revised descriptions of the East Coast of South America and the West Coast of Africa. By W. R. Kettle. London: R. H. Laurie, 1899 [1898]. Size 10 × 6½, pp. 192. *Price* 4*s*. *Presented by the Publisher.*

Carefully brought up to date.

Tropical Diseases. **Koch.**

Reise-Berichte über Rinderpest, Bubonenpest, in Indien und Afrika, Tsetse- oder Surrakrankheit, Texasfieber, tropische Malaria, Schwarzwasserfieber. Von Robert Koch. Berlin: J. Springer, 1898. Size 9½ × 6½, pp. 136. *Diagrams. Price* 2*s*. 6*d*.

Prof. Koch describes, in a series of official reports, the results of his observations on the cattle-disease of Africa at Kimberley, and his preventive inoculation of the plague at Bombay, and of various tropical diseases in German East Africa.

Voyage round the World. **Bullen.**

The Cruise of the *Cachalot* round the World after Sperm Whales. By Frank T. Bullen. London: Elder & Co., 1898. Size 8½ × 6, pp. xx. and 380. *Map and Illustrations. Price* 8*s*. 6*d*. *Presented by the Publishers.*

A vividly written narrative of the voyage of an American whaler round the world in search of sperm whales, ranging over all seas from the North Atlantic to the Sea of Okhotsk and the Southern Ocean.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

POLAR REGIONS.

Polar Regions. **Haardt.**

Nord-Polar Karte. Ausgeführt von V. v. Haardt. Scale 1 : 5,000,000 or 78·9 stat. miles to an inch. Wien : Ed. Hölzel.

This is a wall-map of the north polar regions, showing tracks of expeditions, directions of currents, and limits of the ice at different dates. Ocean depths and elevations are indicated by different shades of colouring. Insets illustrating meteorological and magnetic conditions are given; the northern boundary of permanent human habitation and the limits of vegetation are also shown.

EUROPE.

Educational. ——

Sammel-Atlas. Photocol. Alb.: 1, Schweiz; 2, Würtemberg; 3A, Baden; 3B, Reichslande; 4, Grossh. u. Prov. Hessen; 6, Westfalen; 7A, Prov. Sachsen; 7B, Thüringen; 8, Sachsen; 9, Provinz Brandenburg. Kunst- und Verlagsanstalt Photocol, München. *Presented by the Publishers.*

This is a series of school maps intended, by the aid of pictures, which are marked with the same numbers as places on the map, to teach children by an interesting method, the localities of important places connected with the history and industries of the several countries. Full explanations are given, in German, of this method of teaching.

England and Wales. **Ordnance Survey.**

Publications issued since January 8, 1899.

1-inch—General Maps:—

ENGLAND AND WALES:—234, 250, 265, 278, 281, 296, 327, 351 (revision), hills engraved in black or brown; 59, 68, 117, 130, 133, 170, 172, 179, 186, 197, 199, 234, 280 (revision), engraved in outline. 1*s. each.*

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25-inch—Parish Maps:—

ENGLAND AND WALES (revision):—**Bucks.,** VII. 15, 16; VIII. 8, 12, 13, 15; XVI. 1, 5, 9, 13, 14, 15; XVII. 14; XXII. 2, 3, 5, 9; XXIII. 13, 14; XXIX. 16; XXX. 5. **Buckinghamshire,** XXXII. 8, 9, 11, 13, 14, 15, 16; XXXIII. 6, 7, 9, 10, 11; XXXVI. 4; XXXVII. 7, 9, 13, 16; XLI. 1, 5; XLIII. 15; XLVII. 13, 14, 15; XLVIII. 3, 4, 7, 8, 11, 12, 13, 14, 15, 16; LI. 1, 2, 3, 4, 8, 9, 11, 12, 13. **Cheshire,** VI. 15; X. 15; XII. 6, 10, 15, 16; XVI. 11, 14; XXI. 8; XXII. 1, 3, 7, 9, 10, 11, 12, 13, 15; XXIII. 5, 10, 14, 15; XXX. 2, 4, 6, 7, 8, 10, 12, 16; XXXI. 2, 3, 5, 9, 12; XXXII. 2; XLVI. 6; LII. 1; LIII. 15, 16; LIX. 4, 12, 16; LXIVA. 4. **Cumberland,** LXXXII. 15, 16; LXXXIII. 8, 10, 11, 13, 15, 16; LXXXV. 3, 4, 8, 10, 11, 12, 15, 16; LXXXVI. 2, 6, 7, 10, 11, 13; LXXXVII. 3, 4, 8, 11 and 16; LXXXVIII. 3, 6, 7, 15; LXXXIX. 4 and 8; XC. 6. **Derby,** VIII. 7, 15; XXV. 6; XXVII. 4, 8, 12; XXVIII. 7, 9, 10, 11, 12; XXIX. 5, 8; XXX. 2, 5, 6, 8, 10; XXXI. 5, 6, 7, 8, 9, 10. **Flint,** XXII. 15; XXIII. 14; XXVI. 1, 2, 5. **Glamorganshire,** III. 5, 9, 15, 16; VII. 10, 16; IX. 2, 4, 5, 6, 7, 8, 10; XIV. 14; XXIII. 2, 3, 7, 15; XXXII. 4, 6, 7, 8. **Kent,** LIX. 9, 10, 11; LXVIII. 12, 16; LXIX. 1, 15. **Nottinghamshire,** V. 8, 12, 16; VIII. 4, 8, 12, 16;

XIII. 4, 8, 12, 16; XVIII. 7, 12; XXII. 6, 7, 8, 9, 10; XXIII. 2, 4, 5, 7, 8, 10, 14, 15. **Oxfordshire**, XXXV. 13, 14, 15, 16; XL. 7, 10; XLI. 3, 4, 12; XLII. 9, 13; XLVIII. 1, 5; XLIX. 1, 15; LII. 2, 3; LIII. 1, 13; LIV. 13, 14; LVI. 16; LVII. 5. **Staffordshire**, V. 12. **Sussex**, V. 3, 4, 12, 13, 14, 15, 16; VI. 1, 5, 6, 9, 10, 12, 13, 14, 15, 16; VII. 9, 11, 14; XVI. 1, 3, 4, 6, 7, 8, 11, 12, 15, 16; XVII. 1, 2, 5, 6, 7, 8, 9, 12, 13, 15, 16; XXVIII. 2, 5, 8; XXIX. 4, 9, 10, 11, 13; XLIII. 13, 14, 15, 16; XLIV. 9, 13; XLV. 13, 15, 16; XLVI. 14, 15. **Westmorland**, IX. 14; XVI. 9. 3*s. each.*

(*E. Stanford, Agent.*)

Sweden. **Swedish General Staff.**

Generalstabens Karta öfver Sverige. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheet 90, Hedemora.—Karta öfver Norbottens Lan. Scale 1 : 200,000 or 3·2 stat. miles to an inch. Sheet 41, Stensele. Generalstabens topografiska afdelning. Stockholm. *Presented by the Topographical Section of the Swedish General Staff.*

West London. **Bartholomew.**

New plan of West London. Scale 3·25 inches to a stat. mile. J. Bartholomew, F.R.G.S. W. H. Smith & Son, London, 1899. *Price* 2*s. Presented by J. Bartholomew & Co.*

ASIA.

China. **Friquegnon.**

Chine Meridionale et Tonkin, par le Capitaine Friquegnon de l'Infanterie de Marine. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. Service Géographique des Colonies, Paris, 1899. *Price* 7*s.*

A list of the documents consulted in the compilation of this map is given, from which it appears that the results obtained by all the best-known explorers have been used. The map includes the Yangtse valley on the north, Tongking on the south, Burma on the west, and the western part of the province of Fokien on the east. By reference to the description of the conventional signs given at the foot of the map, information may be gathered on subjects which at the present time are attracting considerable attention.

AFRICA.

Rhodesia. **Stanford.**

Map of Rhodesia divided into Provinces and Districts, under the Administration of the British South Africa Co., 1899. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. London: E. Stanford. 6 sheets. *Price* £1 4*s.*

This is a new edition, on which several corrections and additions have been made to bring it up to date.

AUSTRALASIA.

Brisbane. **Surveyor-General of Queensland.**

Brisbane and Suburbs. Street and Road Map, with Boundaries of Local Authorities. Surveyor-General's Office, Brisbane, 1897. *Presented by the Surveyor-General of Queensland.*

British New Guinea. **Macgregor.**

Map of the Eastern part of British New Guinea. From the most recent Astronomical Observations, Surveys, and Explorations, by His Excellency Sir William Macgregor, M.D., K.C.M.G., C.B., and Officers of the British New Guinea Government. 1898. Scale 1 : 380,160 or 6 stat. miles to an inch. Survey Department, Brisbane. *Presented by the Surveyor-General of Queensland.*

In consequence of the large amount of new survey work performed by Sir William Macgregor, and numerous astronomical observations taken by him, it was found necessary by the Surveyor-General of Queensland to publish the present map on a larger scale than the one previously issued by his department. This map contains a large amount of additional detail, and adds very considerably to our knowledge of the geography of British New Guinea.

ATLANTIC ISLANDS.

Canary Islands. **Rodriguez.**

Maps of the Canary Islands. By D. Manuel Pérez y Rodriguez. 1, Palma, Hierro, and Gomera. Scale 1 : 164,736. 1898.—2, Lanzarote and Fuerteventura. Scale 1 : 202,752. 1898.—3, Tenerife. Scale 1 : 164,736. 1897.—4, Gran Canaria. Scale 1 : 145,728. 1896. Madrid: Hernando y Compañia.

On these maps all roads and tracks are laid down, the altitudes of several of t principal peaks are given in metres, and the importance of towns and villages indicated by the symbols employed to mark their position.

GENERAL.

Exploration. **Schrad**

L'Année Cartographique. Supplément Annuel à toutes les Publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader, directeur des travaux cartographiques de la librairie Hachette et Cie. Huitième Supplément, contenant les Modifications Géographiques et Politiques de l'Année, 1897. Paris: Librairie Hachette et Cie., 1898. *Price 3 fr.*

The first sheet of this useful atlas contains maps showing the routes followed by M P. Bons d'Anty, French Consul, in Southern Yunnan, in 1896–1897. Manchuria, bas on the map published by the Russian Minister of Finance, on which the railways operation, as well as those proposed, are laid down, and two small maps showing I Sven Hedin's routes in Central Asia during the years 1894–1897, as well as his explo tion in the Lob Nor region, 1894–1896. The second sheet contains maps of t countries included in the bend of the Niger, compiled from the most recent materia Abyssinia and the surrounding countries; the basin of the lower Kassai; Southe Abyssinia, showing recent explorations; the country in the vicinity of the bend of t Ubangi; routes followed by Mr. J. Eysséric on the Ivory Coast; and a map showi French explorations in the Sahara in 1897. The third sheet contains maps showi the Chilo-Argentine boundary, at present in dispute; of Southern Patagonia and Tier del Fuego, based on the explorations of Mr. O. Nordenskiöld; Central Alaska and t Klondike region; and the North-West province of Quebec, showing the surveys of I Robert Bell. Each sheet is accompanied by explanatory letterpress.

World. **Andr**

Andrees allgemeiner Handatlas, 126 Haupt- und 139 Nebenkarten auf 186 Kartenseiten, nebst alphabetischem Namenverzeichnis. Vierte, völlig neubearbeitete, stark vermehrte Auflage, herausgegeben von A. Scobel.—Lief 47, Südostfrankreich. —Lief 48, Südamerika, Südliche Hälfte.—Lief 49, Zentralasien und Vorderindien. —Lief 50, Nördwestliches Afrika.—Lief 51, Völker, Religionen und Volksdichte der Erde. Grösse des Handels im Verhältnis zur Volkszahl.—Lief 52, Westliche und Östliche Halbkugel.—Lief 53, Sudamerika.—Lief 54, Europa, Völkerverteilung und Religionsgebiete: Mitteleuropa, Völker, Sprachen und Konfessionsgebiete.—Lief 55, Mittelamerika und Westindien.—Lief 56, Australien: Polynesische Inselgruppen: Karte der Südpolargebiete. Bielefeld und Leipzig: Verlag von Velhagen and Klasing, 1898. *Price 50 pf. each part.*

This new edition of Andree's Allgemeiner Handatlas is now complete, and care h been taken to bring the maps up to date.

World. **Webersi**

Weltpost-Statistik. Telegraphen- und Telephonverkehr, Postsparkassenwesen. Von Gottlieb Webersik, k. k. Postbeamter. Wien und Leipzig: G. Freytag and Berndt. *Presented by the Author. Price 2 marks.*

In this little volume, statistics, graphically illustrated by diagrams, convey son very interesting information with regard to the postal and telegraphic communicatio of the different countries of the world.

By comparing these diagrams for different periods, one is able, by inference, gauge the commercial progress of any country from the increase of its post communication.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralt**

Charts and Plans published by the Hydrographic Department, Admiralty, November and December, 1898. *Presented by the Hydrographic Department, Admiralty.*

No. Inches.

2386 m = 0·45 Scotland, north coast:—Cape Wrath to the Flannan islands, including the northern parts of the North Minch and Lewis. 3*s*. 6*d*.

1996 m = 4·9 Plans on the eastern shore of the Adriatic:—Fiume, including port Martinscica. 1*s*. 6*d*.

1546 m = 0·7 Asia Minor:—Samos strait to Mandelyah gulf. 2*s*. 6*d*.
1536 m = 0·9 Lake Erie:—Long point bay. 2*s*. 6*d*.
3013 m = 4·9 Chile:—Chañaral de las Animas bay. 1*s*. 6*d*.
3008 m = $\left\{\begin{array}{l}1·85\\3·7\end{array}\right\}$ Anchorages in south-east Alaska:—Bartlett bay, Fritz cove, William Henry bay, Barlow cove anchorage, Swanson harbour, Funter bay. 1*s*. 6*d*.
1675 m = 0·93 Africa, west coast:—River Ponga. 1*s*. 6*d*.
625 m = 0·5 Africa, west coast:—River Congo. 1*s*. 6*d*.
638 m = 1·0 Africa, west coast:—River Congo and adjacent creeks. 2*s*. 6*d*.
3010 m = 2·0 Cochin China:—Fuyen and Ku Mong harbours. 1*s*. 6*d*.
1231 m = var. Plans on the western shore of Bering sea:—Seniavine strait, Lozhnuikh Vyestei bay, Karaga harbour, Karaginski island, Baron Korfa gulf, Natalie bay, Anastasia bay, St. Lawrence bay, Uzolnoi bay, Providence bay. 2*s*. 6*d*.
1472 m = $\left\{\begin{array}{l}1·85\\12·0\end{array}\right\}$ Australia, south-west coast:—Hamelin bay, Hamelin inner harbour. 1*s*. 6*d*.
2922 m = 0·5 Australia, east coast:—Turtle group to Claremont point. 3*s*.
1485 m = $\left\{\begin{array}{l}0·7\\5·9\end{array}\right\}$ Caroline islands:—Uap or Yap island, port Tomil. 1*s*. 6*d*.
1384 m = var. Anchorages in Loyalty islands:—Uvea bay, Iatio and Shepenehe anchorages, Tandine anchorage. 1*s*. 6*d*.
1283 Peru, Cape Lobos to Pescadores point:—Plan added, Ocoña anchorage.
2465 Anchorages in Serwatti and Tenimber islands:—Plan added, Lawawang road.
2468 Anchorages in Sumba, Timor, etc.:—Plan added, Naikliu road.
875 Ports and anchorages in China sea:—Plan added, Nau Chau passage.
1040 Kamchatka, Avatcha bay:—New plan, Petropaulovsk harbour.
731 Gilbert islands:—New plan, Nonuti.
Plan added, Apamama.
732 Gilbert islands:—New plan, Makin or Taritari.
17 Santa Cruz islands:—Plan added, Mohawk bay.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
2929	Atlantic ocean, showing currents.		
2386	The North Minch.	New chart. Cape Wrath to the Flannan islands	2386
2385	Scarpa island to Barvas.		
524	Gibraltar New Mole.		
2711	Plans of Fiume and port Martinscica on this sheet.	New chart. Plans on the eastern shore of the Adriatic	1996
1546	Strait of Samos to Mandelyah gulf.	New chart. Samos strait to Mandelyah gulf	1546
1302	Plan of Chañeral de las Animas bay on this sheet.	New chart. Chañeral de la Animas bay	3013
1675	Mouths of the river Ponga.	New chart. River Ponga	1675
625	River Congo.	New chart. River Congo	625
638	River Congo and adjacent creeks.	New chart. River Congo and adjacent creeks	638
1342	Plan of Fuyen and Kumong harbours on this sheet.	New plan. Fuyen and Kumong harbours	3010
1037	Plan of Hamelin bay on this sheet.	New chart. Hamelin bay	1472
2922	Turtle group to Claremont point.	New chart. Turtle group to Claremont	2922
779	Uap or Yap island.	New chart. Uap or Yap island, Port Tomil.	1485
1485	Port Tomil.		
1384	Harbours in Loyalty islands.	New chart. Anchorages in Loyalty islands	1384

Charts that have received Important Corrections.

No. 1607, England, east coast:—North Foreland to the Nore. 2308, Norway:—Brand fiord to Leka. 2334, Lapland:—Oleni Nyemetzki island to Nokuev island. 2280, White sea:—Arkhangel bay. 2964, Arctic Russia:—Head of the gulf of Ob. 2842B, Baltic sea. 689, Gibraltar harbour. 150, France, south coast:—Marseille port and roadstead. 2884, Gulf of Mexico:—Legaré anchorage. 554, South America:—Magellan strait. 1897B, British Columbia:—Victoria harbour. 704, Madagascar:—Nosi Shaba to Moramba bay. 833, Bay of Bengal:—Rangoon river and approaches. 2637, Strait of Makassar, south part. 1754, China:—Tung Yung to Wen chau bay. 1708, Australia, north coast:—Albert river. 1055, Australia, west coast:—Bedout island to Cape Cuvier. 939, New Guinea:—Cape Nelson to Hercules bay. 1096, New Zealand:—Current basin and French pass. 731, Gilbert islands. 184, Harbours and anchorages in New Hebrides. 1829, Fiji islands to Samoa islands. 1757, Fiji islands:—Nukulau island to Namuka island. 2421, Tonga or Friendly islands.

(*J. D. Potter, Agent.*)

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic and North Pacific Oceans for February, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Columbia. **Gledhill.**

Twenty-four Photographs of the Republic of Colombia, taken by E. Gledhill, Esq., 1897. *Presented by E. Gledhill, Esq.*

As will be seen by the following list, this series of photographs includes a number of interesting subjects, both as regards the buildings, groups of natives, and scenery of Colombia.

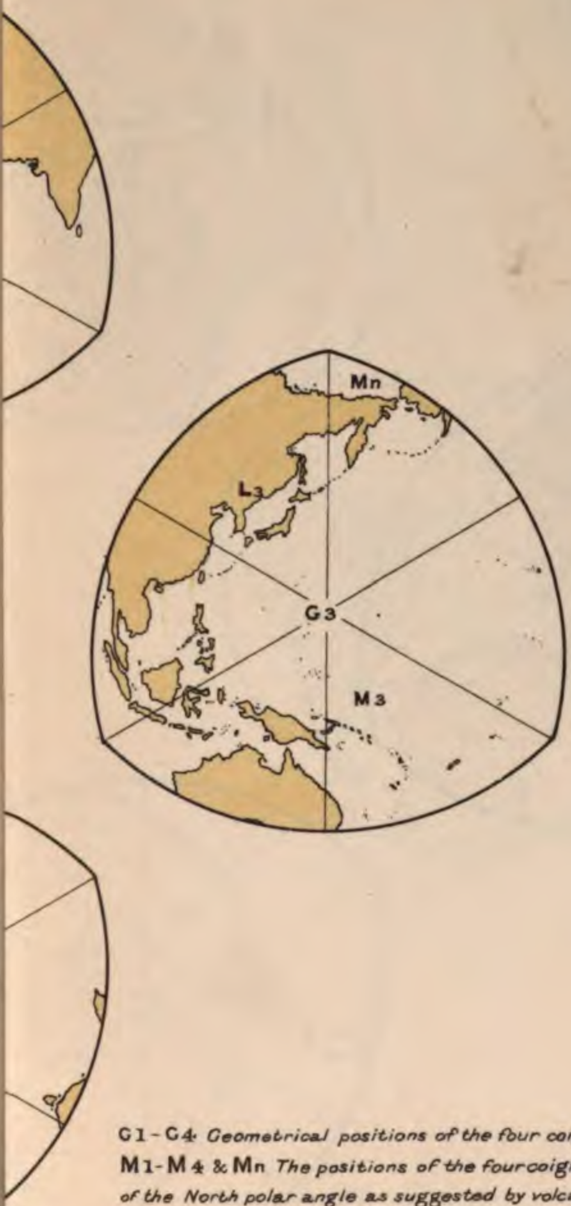
(1) The Cathedral (Plaza San Nicolas), Barranquilla; (2) Cathedral Plazuela (San Nicolas), Barranquilla; (3) El Camillon (Parade), Barranquilla; (4) Royal Mail Offices, Barranquilla; (5) Street and hotel, San Carlos, Barranquilla; (6) Custom-house, Santa Marta; (7) General view of Santa Marta, looking south-east from the sea; (8) Santa Marta, with Atlas steamer *Alps* loading bananas; (9) Street in Santa Marta, in which is situated the British Consulate; (10) Cathedral and street in Santa Marta; (11) Market hall and Plaza de la Regeneracion, Santa Marta; (12) Goajira Indians, Rio Hacha, Dept. of Magdalena; (13) Street scene on a Sunday, Rio Hacha: waiting to be photographed; (14) Characteristic groups and street in Rio Hacha; (15) Church and Plaza, with typical Indians, etc., Rio Hacha; (16) Beach and Custom-house, Rio Hacha; (17) Street scene, Cartagena; (18) Street in Cartagena; (19) Police barracks and street view, Cartagena; (20 and 21), View along old Spanish walls of Cartagena; (22) Outer portion of old Spanish fortifications near the sea; (23) View from Murallas (walls), with fortress of San Felipe in distance; (24) Walls and Rain-water tanks, Cartagena.

West Africa. **Yankah.**

Sixteen Photographs of Sierra Leone, Congo Railway, and Gold Coast, taken by J. T. N. Yankah, Esq. *Presented by J. B. Esuman-Gwira, Esq.*

The following is a list of these photographs: (1) Secondi market-place; (2) Fanti artisans; (3) Scene at Cape Lopez; (4) Gabun Government house; (5) Secondi railway; (6) Matadi market-place; (7) Secondi railway: laying of the first rail by Governor Hodgson; (8) Sunday school, Saltpond, Gold Coast; (9) Secondi railway station; (10) Secondi railway; (11) Secondi chief and headman; (12) Secondi; (13) Opening of the railway at Matadi; (14) Sierra Leone from the sea; (15) Secondi railway: the pier; (16) Singing band, Saltpond, Gold Coast.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



G1-G4 *Geometrical positions of the four coigns*
M1-M4 & Mn *The positions of the four coigns and of the North polar angle as suggested by volcanic evidence (Michel Lévy)*
L1-4 *The positions of the coigns from geological evidence (after de Lapparent).*

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The

Geographical Journal.

No. 4. APRIL, 1899. Vol. XIII.

EXPLORATION IN THE CANADIAN ROCKIES: A SEARCH FOR MOUNT HOOKER AND MOUNT BROWN.*

By Prof. NORMAN COLLIE, F.R.S.

The history of the exploration of the Rocky mountains of Canada is one full of interest. It deals with the early struggles of the fur traders of the North-West Territory, later with the search after gold, and finally with the story of how a railway was built, almost regardless of expense, through the wild canyons of the West—a railway that for hundreds of miles passes through thickly wooded valleys, over lofty mountain passes, across raging torrents hundreds of feet below, till finally it reaches the Pacific coast at Vancouver.

By far the fullest, most accurate, and interesting account of travel and observation amongst the Rocky mountains is that of Captain Palliser and his party, during the years 1857–60. This expedition was organized by the British Government in order that a route might be discovered between eastern and western Canada. Up till then only one pass over the Rocky mountains in Canadian territory was known with certainty, namely, the Athabasca; the Palliser expedition "was to ascertain whether one or more practicable passes existed over the Rocky mountains within British territory, and south of that known to exist between Mount Brown and Mount Hooker." During their explorations they discovered and laid down the following: the Kananaskis pass, the Vermilion pass, the British Kootanie pass, the Kicking Horse pass. All these passes traverse the watershed of the continent within British territory. Dr. Hector also traversed the Howse pass, between the head-waters of the Saskatchewan and the Columbia rivers.

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* Read at the Royal Geographical Society, February 13, 1899. Map, p. 464.

Ten years later British Columbia entered the Dominion of Canada, and at once the Government survey for the Canadian Pacific railway was started. It was amongst the Rocky mountains that the difficulty of selecting a route was most evident. No less than eleven different ways across the mountains were surveyed, from the Peace river in the north to the Crow's Nest pass in the south. This survey alone is said to have cost between three and four million dollars; but finally the Canadian Pacific railway was opened in 1886, after nearly one hundred and fifty million dollars had been expended on its construction. The opening of the railroad of necessity largely stopped the use of the old passes, but at the same time enabled those who wished to travel in the mountains in search of game or amusement to do so with much greater facilities.

It is only, however, within the last few years that many sporting, exploring, or mountaineering expeditions have made use of these opportunities. Members of the Appalachian Club of Boston have spent several seasons amongst the peaks and glaciers near Glacier House, Laggan, and Field on the railway. Prof. Coleman undertook a journey from Morley to the sources of the Athabasca river, in order to search for the two peaks Brown and Hooker, of which little was known except that they had been discovered about sixty years previously, and were supposed to be 16,000 and 15,000 feet in height.

Mr. W. D. Wilcox,* in the mean time, had explored the mountainous country south of the Canadian Pacific railway, as far as Mount Assiniboine, and north to the Saskatchewan and Athabasca. His experiences have been published in a delightful book, 'Camping in the Canadian Rockies in 1896.' Most of our knowledge, therefore, at the present time, of that part of the mountains which lies 100 miles to the north or to the south of the railway at Laggan, is either knowledge gained in the early part of the century by traders in the employ of the fur-trading companies, or from Palliser's 'Journals,' or Wilcox's book on Mount Assiniboine and the surrounding country.

For the most part, these explorations have been restricted to the valleys and low passes; very few attempts have been made to locate or explore the great snow-fields and the surrounding peaks that form the great backbone of the country. To take the Alps as an example, it would be a parallel case if a few parties had started from Geneva, explored the St. Bernard pass, pushed up the Rhone valley over the Furka pass and the St. Gotthard, without much troubling themselves about either the snow-fields of the Oberland or the side valleys and great peaks on the main Pennine chain with their attendant glaciers. This paper deals with two journeys taken during 1897 and 1898 through that part of the Canadian Rockies that lie between the Kicking Horse pass on the south, and to the source of the Athabasca river on the north. At first, in 1897, I did not intend to trouble myself with exploration—the expedition was merely to be a mountaineering one; but, soon finding that the maps, such as they were, covered only a very small portion of the ground I proposed to go through, and as no knowledge whatever of the snow-fields and peaks seemed to exist, it at once became obvious that exploration might very well be combined with the mountaineering.

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* See p. 358.

At the beginning of August, in 1897, whilst on the summit of a snow-peak (Mount Gordon, 10,600 feet) that lay about 20 miles north of the railway at the continental divide, a high mountain was seen 30 miles away to the north-west. It seemed much higher than all its neighbours, and we were of the opinion that it probably might be Mount Murchison. I had intended to go south and visit Mount Assiniboine and the country in the immediate vicinity, but the sight of this splendid mountain made me at once change my plans, and on returning to civilization at Banff a few days later, Mr. G. P. Baker and I determined to go north instead, in order to, if possible, get to the foot of this mountain, and afterwards, perhaps, should we be fortunate, to climb it as well.

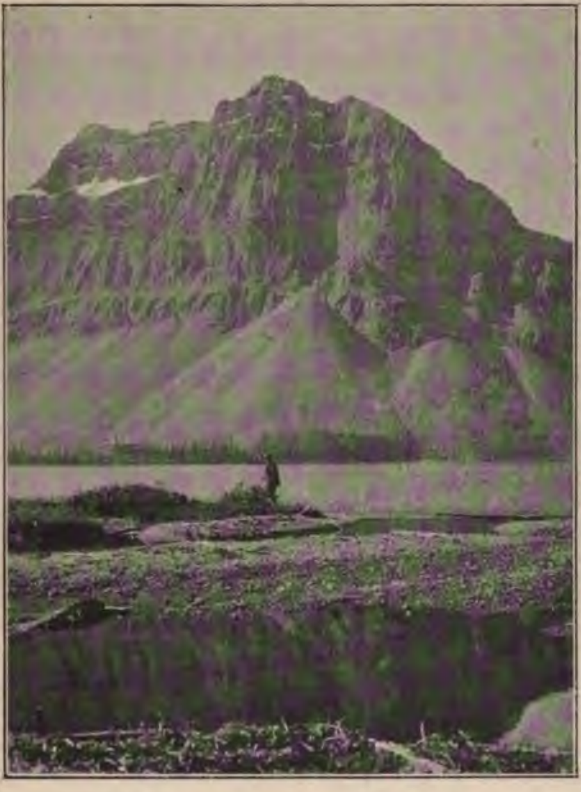
FALLS OF THE BOW RIVER, BANFF.

We accordingly hired an "outfit" from T. Wilson, of Banff, who supplies men, horses, and provisions for such expeditions to the mountains. Although Wilson, years before, whilst working for the Canadian Pacific railway, had been in the country we wished to visit, yet he did not remember ever having seen a very high peak about the spot where we thought we had seen one when on the summit of Mount Gordon. This, however, did not dishearten us much, for we knew from experience that it is only from the tops of mountains that any really accurate ideas could be obtained of the relative heights of surrounding peaks.

On August 17 we started from Laggan station up the Bow valley. The lower portion of the valley is rapidly becoming impassable owing to fallen trees; for the forest was burnt during the time that the Canadian Pacific railway was being built, and now after fifteen or more years the roots of the burnt firs have become thoroughly rotten; every fresh gale brings down large numbers of those still standing, adding to the almost inextricable tangle below. It is quite possible in this part to walk for more than a mile along the fallen stems, never being nearer than two feet, and sometimes finding one's self as much as ten or more feet, from the ground.

LAGGAN STATION AND MOUNT VICTORIA

Our party consisted of G. P. Baker and myself, P. Sarbach (a Swiss guide), W. Peyto, L. Richardson, and C. Black, cook. The weather was excessively hot, and the mosquitoes swarmed in countless thousands, making life miserable. The horses, moreover, were heavily laden, so we travelled but slowly. It was not till the third day that we arrived at the head of the Bow valley, where a pass leads over into Bear creek or the Little fork of the Saskatchewan. This pass is similar to many in the Rocky mountains. The woods—that down in the valleys are usually so thick that it is impossible to see far ahead, and, owing to fallen trees, make it most difficult to get the horses along—on the passes open out, and large open stretches of grass alternate with groves of pine trees that act as shelter for tents. Often small lakes are found as well, and the views of snow-clad peaks, glaciers, lakes, and forest make most beautiful pictures. The scenery at the head of the Bow valley surrounding the upper lake is grand, and will not disappoint any one who should make the journey there. The lake, also, is full of trout; some weighing as much as 30 lbs. have been caught. We stopped a day on the pass for two reasons: the horses needed a rest, and Baker wished to pick up his points in a plane-table survey that had been started by Mr. Herschel C. Parker, of Brooklyn, N.Y., during our trip a week before when we ascended Mount Gordon.



THE UPPER BOW LAKE.

Mr. Parker took as his base-line the distance between two stations in the Bow valley that had been trigonometrically determined by the Canadian Government for their photographic survey. These two points were 6·365 miles apart. One south of Mount Hector, and marked on the Government Survey sheet as station No. 1, 9830 feet; the other a peak lying on the opposite side of the valley, north of the Upper Bow lake, marked station No. 2, 9178 feet. When Mr. Parker returned to the States, he kindly handed over his map to Baker to continue it to the north. On August 20, Baker, Sarbach, and I ascended a rock and snow-peak south-west of the pass (9100 feet), from which a good view down both the Bow valley and Bear creek could be obtained, thus enabling Baker to add a large number of extra points to his map. A fine specimen of a trilobite was found on this summit.

The Bow pass is about 6700 feet. On the north-west side the trail descends steeply for 1000 feet to Bear creek, down which flows the Little Fork of the Saskatchewan river. This branch rises in a large glacier above Peyto lake.

Halfway down the valley two more lakes were passed, on which were seen several kinds of water-fowl, whilst on the eastern side of the valley the woods had only recently been burnt. The gaunt shining black stems of the trees formed a curious but fitting background for the mass of brilliant golden-yellow daisies that were in full bloom amongst the stones at their feet. And the ruined woodland, clothed in black velvet and gold, harmonized in its two dominant colours with the sapphire sky above; but at the same time the lifeless trees, without a vestige of green, gave a curious and weird aspect to the scene.

On August 23 we reached the main Saskatchewan, and on the next day with some difficulty got our horses over the Bear creek river, for it was in full flood owing to the hot weather and the immense amount of melting snow. The following day we climbed Mount Sarbach, 11,100 feet, the most northerly peak of the Waputehk range. Unfortunately, the clouds were low on the mountains, so we were unable to distinguish with certainty where the high peak we were in search of might be; but to the westward a splendid glacier was seen, winding down from a snow-covered range beyond. Away to the north-west lay Glacier lake, fed by the waters from a large snow-field, at whose head two peaks, one snow-covered and one black rock, rose into the drifting clouds. These peaks, we afterwards discovered, were probably the Mount Lyell of Hector.

On August 27 we arrived at the foot of the valley leading to the glaciers we had seen two days before from Mount Sarbach, towards the westward. Directly to the north of us was the peak we were in search of. Later on, consulting Palliser's 'Journals,' we found that this peak was not Mount Murchison, as we had supposed, but Mount Forbes, discovered by Dr. Hector, and estimated by him to be about 13,400 feet. Mount Forbes is certainly one of the highest peaks in the Canadian Rockies, and must be close on 14,000 feet. I have seen it on every side except the north-west, and it always towers as a huge three-sided pyramid at least 3000 feet above the surrounding peaks, which are from 10,000 to 11,000 feet high. The precipice on its eastern face is more sheer than the western face of the Matterhorn, and even after a heavy snowfall remains black and forbidding. On its northern side the peak must stand about 7000 feet above the glacier at its base.

Up till this date the weather had been perfect, but on the 27th a change for the worse began, which rendered climbing on the high peaks impossible. However, whilst waiting for the snow to melt off the precipices and *arête* of Forbes, the valley and large glacier to the westward were explored. Hector seems to be the only person who had ever visited this glacier (Palliser's 'Journals,' p. 150).

AT THE HEAD OF THE FRESHFIELD GLACIER.

At the head of the glacier a large ice-field (Freshfield glacier) was traversed, and an attempt was made to climb the highest of these—Mount Freshfield, about 12,000 feet—but, owing to want of time, the party was unsuccessful.

From the highest point reached, 10,000 feet, a very lofty mountain—probably 14,000 to 15,000 feet—was seen lying 30 miles away in a north-westerly direction. Only two peaks north of Lyell are marked on the map, and these are Mount Brown and Mount Hooker, which are supposed to be 16,000 and 15,000 feet high respectively; consequently we at once took it for granted that we had seen one of them. On September 1 we made our only attempt to climb Mount Forbes, but did not succeed; the rain, snow, and wind driving us back wet through, after a most unpleasant night spent in the woods at the foot of the mountain. It was now time to think of returning to civilization; moreover, we had heard tales of how, at the beginning of September before the Indian summer sets in heavy snowfalls often occur in the mountains, necessitating a halt till most of the snow melts. As none of us were desirous of spending the best part of a week snowed up in camp, we concluded that we had better make all haste for the north branch of the Kicking Horse river, and follow it down to Field station on the railway.

Accordingly, we pushed over the Howse pass into the Blaeberry creek. Soon all signs of a trail were lost; the forest, being on the western slopes of the mountains, became thicker, and great difficulty was experienced in getting the horses backwards and forwards over fallen timber and the stream that increased in size every mile down the narrow valley. At last we found the valley opening a little, and came to a trapper's deserted log cabin. A single man seemed to have inhabited it, and we wondered who it might be, that, for the sake of a few martin-skins, had lived there alone through a whole winter. A more desolate spot could hardly be found, hemmed in on all sides by gloomy mountains that during the winter months shut out the sun's rays, exposed to the full force of the south-west gales that would sweep with increased force up this narrow slit through the main chain of the Rocky mountains. It was no wonder that we found it deserted.

Wilson had told us that some years previously he had attempted to take horses down the Blaeberry creek to the Columbia river, but he had to abandon them in the heavy timber about halfway down the valley; eventually it was only with the help of some men a week later that he was able, after several days' hard work, to cut them out of the fallen trees. We had now arrived at the beginning of this part of the creek. Peyto, who had gone forward to find the trail, returned with the information that at the next bend of the stream, just below Mount Mummery, the fallen pine trees were so numerous that it would take a week to clear half a mile for the horses. Moreover, a forest fire had been burning for at least a fortnight just below, the smoke of which we had first seen from the summit of Sarbach; however, in spite of all the rain that had fallen, it was still alight. Whilst Peyto was exploring down the valley, we had climbed a peak about 8000 feet high on the west side of the stream. From this point we were able to see a depression in the chain on the opposite side, which we thought probably would lead to the north branch of the Kicking Horse river. But we also saw that great difficulty would probably be experienced in finding a trail up which horses could be taken. Next day, whilst Peyto was again exploring down the valley, Sarbach and I prospected the ground that we thought would be the best route for the horses to follow towards the pass. It was excessively steep, but, as our horses now were in good condition and the loads light, when in the evening Peyto returned with the intelligence that it was hopeless to attempt to follow the Bleaberry creek further, we made up our minds to try on the morrow the new pass to the south.

Next day, after an ascent of about 3000 feet, we camped at the limit of the pine trees at 7500 feet, and on the following day, after a couple of hours' march, reached the pass, where we camped. During the night a heavy fall of snow occurred, which had the effect of clearing away the clouds and bad weather that we had been experiencing since the 27th. This pass (6800 feet) I have named "Baker" pass, after my friend Mr. G. P. Baker. We were certainly the first to cross it with horses, and it seems to be the only route that can be used on the western side of the watershed for baggage animals that will connect with the upper waters of the Bleaberry creek. The next day, September 7, in brilliantly fine weather, we crossed the pass, and, following the north branch of the Kicking Horse river down a very beautiful valley, we arrived at Field on September 9. Baker and Sarbach on the 9th ascended Mount Field from the western side. It is worth while mentioning that the various streams in the north branch abound with trout. From Field we returned to Banff by rail, and thus ended the expedition of 1897.

During the winter of 1897–98 I had, of course, much time and opportunity to consult all the various works and papers on the Canadian Rockies. I obtained a copy of that rare Blue-book, Palliser's 'Journals,' and was surprised to find how much of the ground that we had travelled over had been carefully and accurately described by Dr. Hector. All local knowledge of the district dates from the Canadian Pacific railway survey; the older work has been entirely forgotten. By far the most interesting problem, however, that presented itself to me was, whether the mountain I had seen from the slopes of Mount Freshfield might be Mount Brown or Hooker. Certainly Prof. Coleman, in 1893, starting from Morley, had arrived at the true Athabasca pass, found the historic Committee's Punch-bowl, and his brother had climbed the highest peak on the north, presumably Mount Brown. This peak he found to be only 9000 feet. Could he have been mistaken, or was it possible that there existed two Athabasca passes? The first alternative was almost impossible; there was no doubt whatever that the Athabasca pass had been reached. The second alternative was more difficult to solve. On searching for information as to the individual who had named Brown and Hooker, all I could find were some few references to the botanist, D. Douglas, after whom the Douglas pine is named. Nowhere was there an account of the actual passage through the mountains; nowhere could I find any authentic description or measurement of these peaks except Prof. Coleman's. That the two highest peaks in the Rocky mountains, peaks that have appeared in every map of Canada for the last sixty years, peaks that every Canadian has been taught at school may be found amongst the western mountains beyond the prairies—that these mountains were only, after all, not so high as thousands of others in the main chain, seemed impossible to believe. However, the best way to solve the difficulty was obviously to return next summer to the mountains, and find out about the high mountain I had seen from the slopes of Mount Freshfield, 20 miles or more to the north-west of Mount Forbes.

In July, 1898, H. Woolley, H. E. M. Stutfield, and myself crossed over to Canada for this purpose; we also wished to continue the map that Baker had been working at the year before; and again, as far as possible, the expedition was chiefly to be a mountaineering one.

On July 31 we started from Laggan, with W. Peyto as our headman; Nigel Vavasour, Roy Douglas, and M. Byers as cook also accompanied us. We started with thirteen riding and baggage ponies, but within an hour of starting reduced that unlucky number to twelve, for we had to shoot one of the worst of the pack after it had broken its shoulder amongst the dead timber. Instead of following up the Bow valley as we did in 1897, I determined to reach the Saskatchewan river by way of the Pipestone pass and the Siffleur valley, in order that we might investigate Mount Murchison. Dr. Hector mentions that it can be plainly seen from the summit of the Pipestone pass, and, in fact, gives a sketch of the mountain as seen from there; I therefore climbed a small peak (8800 feet) that rises out of the centre of the pass (8400 feet). From this point two peaks similar to those in Dr. Hector's illustration could be seen 10 to 15 miles away to the north-west, somewhere between the bottom of Bear creek and the Saskatchewan. This mountain I had noticed last year from Mount Sarbach, when I was at an elevation of 11,100 feet, and although Murchison is higher than Sarbach, yet it cannot be much over 12,000 feet high, if as much. On three separate occasions I have seen all the peaks that lie between the Pipestone, Siffleur valley, and the main range, and always the mountain on the east side of the foot of Bear creek seemed to be the highest. The Siffleur valley is easy to travel in; for the last 15 miles the trail is on the left bank.

We reached the Saskatchewan and the Kootenay plains on August 26, only to find the river in full flood, and in some places even over its banks. Next day we nearly lost half of our horses and baggage. In attempting to round an excessively awkward corner where the trail was partly under water, one after another of the horses fell in, and were rapidly swept away by the swiftly running river. Some of them drifted ashore a short distance below, but some landed on an island out in the middle of the stream, and for some time refused to return. Eventually they were all collected, and we had to camp at once in order that the baggage might be dried. On August 8, after a very long day, we arrived on the old spot at the bottom of Bear creek, having taken two days longer than if we had come by the Bow valley.

We had intended to make an attempt to climb Mount Forbes, but the rivers were in such a state of flood that we determined to at once push on up the north fork of the Saskatchewan, and it was most fortunate that we did so, for in four days we did not make 10 miles up that valley.

August 9 was our first rest. We went carefully over our provisions, and as we were to return by this route, we "cached" a certain quantity here at Bear creek. Next day the nasty and somewhat dangerous crossing of Bear creek was accomplished safely, and later in the day we managed to find a ford across the Saskatchewan, about 2 miles west of where the north fork joins the western branch; we camped that night on the spit of ground at the junction (4600 feet). On August 11, from the summit of a peak (8650 feet) which I have named Survey peak, I started the plane-table survey, taking Baker's points of the previous year. Unfortunately, it was useless to try to photograph, owing to the smoke haze that covered everything. This haze we first noticed, as we descended the Siffleur valley, drifting southwards; it continued till the bad weather set in four weeks later. The top pyramid of Mount Forbes was visible over a nearer range that descends to the shore of Glacier lake. Mount Murchison and Mount Sarbach were plainly visible, but Mount Lyell, much to my disappointment, was hidden. The day was sultry, and for the most part the sky was overcast; the mosquitoes even followed us for 1500 feet above the tree-line on to the snow-patches that covered part of the mountain.

FORDING THE SASKATCHEWAN.

The trail up the North Fork of the Saskatchewan is on the east or left bank of the river, but it was absolutely impossible for us to attempt

Fork, flat-topped and covered with snow; on its eastern face a precipitous wall of rock. Mount Lyell and Mount Forbes could be seen far off in the haze. But it was towards the west and north that the chief interest lay. We were looking on country probably never before seen by human eye. A vast snow-field, feeding many glaciers, lay at our feet, rock-peaks and snow-covered mountains were ranged around it, whilst far away to the westward we could just see through the haze the valley of the Columbia river. This great snow-field, from which the Saskatchewan glacier takes its rise, also supplies the ice for another glacier at the headwaters of the Athabasca; whilst to the west we saw the level snows bending over to flow down more than one channel, feeding, when melted, the rivers that empty themselves into the Pacific ocean.

A magnificent peak, that is probably near to 14,000 feet high, stood alone keeping guard over these unknown western valleys. We have ventured to name it after the Right Hon. James Bryce, President of the Alpine Club. Some few miles to the north of this peak, and also on the opposite side of the snow-field in a north-westerly direction, the biggest peak of all was seen. Chisel-shaped at the head, covered with glaciers and ice, it also stood alone, and I at once recognized the great peak I was in search of; moreover, a short distance to the north-east of this peak another, almost as high, also flat-topped, but ringed round with sheer black precipices, reared its head above all its fellows into the sky. Here, then, we thought, were Brown and Hooker. Rapidly I drew lines in all directions to these new peaks on my plane-table, but hurry as fast as I could, it was 6.30 p.m. before we started down from the summit of this mountain, which we have named Athabasca peak. Its height by mercurial barometer is 11,900 feet. It was 10.45 when we got back into camp, to find that Stutfield had killed three if not four sheep. The provision question, therefore, was satisfactorily settled for some time to come.

The glacier that fed the headwaters of the Athabasca river we have called the Athabasca glacier. Two days later we all three camped with sleeping-bags as far up its right bank as possible, and in the dark at three o'clock next morning started up the glacier by lantern-light. This glacier descends from the snow-fields above in three successive icefalls, the last one very much crevassed. It was not till past seven o'clock that we finally emerged on to the snow-fields above. The day was warm and sultry, making us all feel tired. For several hours we walked across the snow towards the high chisel-shaped peak; to the westward Mount Bryce sent its three peaks high above us into the air. A double-headed peak on the north hid the high rock peak we thought might be Brown (afterwards named Mount Alberta), when we were on the top of the Athabasca peak. But the peak we were walking towards was farther off than we thought, and as it seemed very unlikely that we should get to the top of it that day, we turned, after having looked down into a vast amphitheatre that lay between the chisel-shaped peak (afterwards named Mount Columbia) and the double-headed peak, or the Twins. This amphitheatre is the source of another branch of the Athabasca. To the south-east of where we were, and almost on our way home, rose a great dome of snow. After a hot and very tiring climb through soft snow that broke under our feet at every step, we finally got to the summit at 3.15 p.m. (11,650 feet). Although we did not know it at the time, we were standing on probably the only peak in North America the snows of which, when melted, find their way into the Pacific, the Arctic, and the Atlantic oceans; for its glaciers feed the Columbia, the Athabasca, and the Saskatchewan rivers.

But our expedition had mystified us more than ever about Mounts Brown and Hooker. There was no pass between the two highest peaks we had seen, and where was the Committee's Punch-bowl that should lie between them? It is true that we had only seen a small portion of that western branch of the Athabasca whose source lay at the feet of these peaks, but at the same time we had seen that this western branch at its head was hemmed in by the highest mountains in the Canadian Rockies.

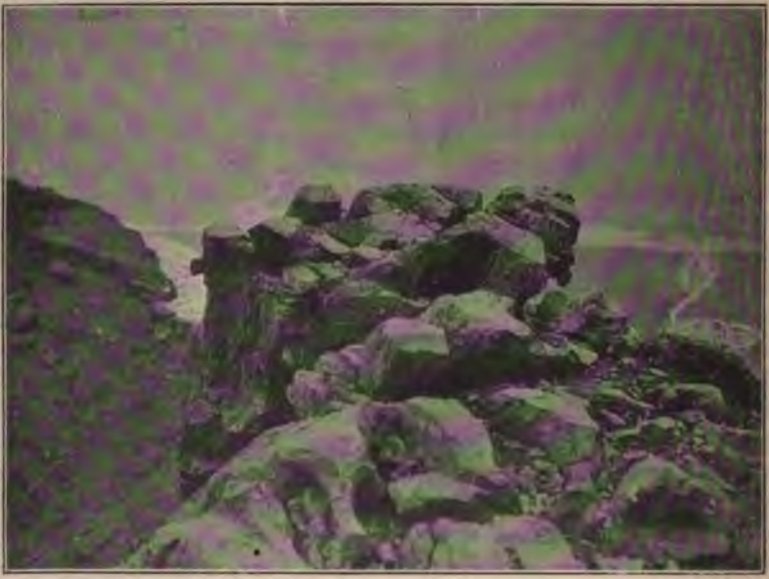
Our next move was in search of the lost Punch-bowl. The weather, although it looked unsettled, still kept fine, and on August 24 we took part of our camp for a three or four days' expedition across the pass and down into the east branch of the Athabasca river, hoping to find a pass through to the westward, which would join the east with the west branch. We soon found that no such pass existed, and that to ascend this western branch to its source we should have to descend the eastern branch for at least 25 miles to the junction of the two streams. For this we neither had time nor provisions; so we had to content ourselves with camping out near a glacier (Diadem glacier), and ascending a peak, Diadem peak (11,500 feet). From the summit we looked over into the western branch of the Athabasca, and only a few miles away the flat-topped rock peak (Mount Alberta) rose above us more than 2000 feet. It was during the ascent of Diadem, on August 26, that the weather finally broke, thunderstorms and hail driving us back wet through to our camp.

We returned to our camp on the Wilcox pass the next day, without having solved the question of either Mounts Brown or Hooker, or the Committee's Punch-bowl. Our provisions were now again getting very short, so there was nothing to be done except turn homewards towards Bear creek; the weather also was getting worse and worse. On August 28 we started: Stutfield and Peyto made a *détour* round the Sheep hills and over on to the headwaters of the Brazeau, to try and find some more sheep, but were unsuccessful.

All day on August 30 we were kept in a camp some distance down the North Fork of Saskatchewan by deluges of rain. But on the following day, August 31, by getting up very early and pushing on till 5.30

in the evening, we managed to reach the camp at the foot of Bear creek, where our provisions were "cached." During this march, which was made on the east or left bank of the river, we passed no less than five camps we had made about a fortnight before on the opposite side.

From this camp at Bear creek, on September 2, we attempted to climb Mount Murchison, but, owing to the bad weather, only succeeded in reaching a point about 8800 feet on a ridge. On this ridge some most interesting fossil remains were found of what looked like a petrified pine forest, where the trees had been broken off about a foot from the ground. I have been told, however, that it may be the remains of some gigantic prehistoric seaweed. For the next two days the weather continued gloomy and damp till the afternoon of the 4th, when a heavy snowstorm came on, which forced us to camp in a cold and miserable spot just short of the Bow pass. But this was the last of the bad weather, and the week that followed was gloriously fine; the haze that had hidden all the distant views during the first four weeks of our trip was gone, and two days later, when we ascended a peak (Thompson peak) lying just on the north of the top of the great icefall of the upper Bow glacier, from its summit (10,700 feet) by far the most distant and clear view that we had during the whole of the expedition was obtained. Mounts Assiniboine, Forbes, Sir Donald, Freshfield, Lyell, and those over the Athabasca, were clearly visible. The peak was covered with fresh snow.



FOSSIL REMAINS ON MOUNT MURCHISON.

On September 8 we arrived at Laggan railway station, having been away from civilization for nearly six weeks. The link with the mountains and camp life was broken; it was hard to realize that we should no longer sleep under an Indian "teepee" in a sleeping-bag, and feel the fresh air play over our faces during the still nights, nor should we listen to the noises of the streams nor the wind in the pines much longer. Our small world was shattered, our conversation and all the small things that had interested us for the last six weeks, when placed before the inhabitants of the civilized world, would either fail to interest or fall on the ears of those who would not understand. Still, civilization has its advantages, and gains much by contrast with the life that is experienced amongst the mountains and the wild and desolate places of the Earth.

MOUNT ABERDEEN.

It was not till I had returned to England that the question of the Committee's Punch-bowl and Mounts Brown and Hooker was finally solved. Again, with greater care, I looked up every reference I could find that dealt with the Rocky mountains of Canada and British Columbia. At last I discovered a reference in Bancroft's 'History of

British Columbia' to the journal of David Douglas the naturalist, which had been published together with a variety of other matter in the *Companion to the Botanical Magazine*, vol. ii. pp. 134–137, by Dr. W. T. Hooker.

This journal deals with Douglas's journey over the Athabasca pass. He started from Vancouver on March 20, 1827, and, travelling *viâ* the Kettle falls and the Columbia river, reached Boat Encampment on April 27, and the summit of the Athabasca pass on May 1 at ten o'clock in the morning. To quote his journal: "Being well rested by one o'clock, I set out with the view of ascending what seemed to be the highest peak on the north. Its height does not appear to be less than 16,000 or 17,000 feet above the level of the sea. After passing over the lower ridge, I came to about 1200 feet of by far the most difficult and fatiguing walking I have ever experienced, and the utmost care was required to tread safely over the crust of snow. A few mosses and lichens are observable, but at an elevation of 4800 feet [*] (*sic*) vegetation no longer exists. The view from the summit is of too awful a cast to afford pleasure. Nothing can be seen, in every direction far as the eye can reach, except mountains, towering above each other, rugged beyond description. . . . The majestic but terrible avalanches hurling themselves from the more exposed southerly rocks produced a crash, and groaned through the distant valleys with a sound only equalled by that of an earthquake. Such scenes give a sense of the stupendous and wonderful works of the Creator. This peak, the highest yet known in the northern continent of America, I feel a sincere pleasure in naming 'Mount Brown,' in honour of R. Brown, Esq., the illustrious botanist. . . . A little to the southward is one nearly the same height, rising into a sharper point; this I named 'Mount Hooker,' in honour of my early patron, the Professor of Botany in the University of Glasgow. This mountain, however, I was not able to climb.

"The Committee's Punch-bowl is a small circular lake 20 yards in diameter, with a small outlet on the west end, namely, the Columbia, and another at the east end, namely, one of the branches of the Athabasca."

This, then, was the authentic account of these two mountains, and to Prof. Coleman belongs the credit of having settled with accuracy the real height of these peaks. For nearly seventy years they have been masquerading in every map as the highest peaks in the Rocky mountains.

No doubt now remains as to where Brown and Hooker and the Punch-bowl are. That Douglas climbed a peak 17,000 feet high in an afternoon is, of course, impossible; the Mount Brown of Prof. Coleman, 9000 feet high, is much more likely. There is, therefore, only one

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[*] 14,800 feet more probable.

Athabasca pass, and on each side of its summit may be found a peak; the higher of the two is on the north side—it is Mount Brown, 9000 feet; on the south side the mountains are still lower, and one of the points on the ridge is Mount Hooker. Between them lies a small tarn, 20 feet in diameter—the Committee's Punch-bowl, that may be found marked in almost every map of Canada.

Those peaks to the south, amongst which we wandered last August, are therefore new; and standing as they do, grouped round the glaciers that feed three of the largest rivers in Canada, the Athabasca, the Saskatchewan, and the Columbia, they probably constitute the highest point of the Canadian Rocky mountain system.

Before the reading of the paper, the PRESIDENT said: The paper to be read this evening will be a very interesting one by Prof. Norman Collie on "The Exploration in the Canadian Rocky Mountains, and the Search for Mounts Hooker and Brown."

After the reading of the paper, the following discussion took place:—

Mr. G. P. BAKER: You will have observed that the little geographical and map-making work which the two expeditions led by Dr. Collie have accomplished, is due more to our mountaineering instincts than to a search after geographical knowledge. Dr. Collie has told you that we were in a country beyond the limits of the map-maker, and that it was due to T. E. Wilson, of Banff, that we were able to obtain some information of the country we were to traverse. He was able to indicate on paper the number of lakes and washouts we were likely to pass, the glaciers we should see, and muskegs to avoid. I seized the opportunity offered me by Mr. Parker, of Columbia University, to obtain the reversion of his plane-table, and by accident we were able to pick up the survey of the Topographical Department of Canada, and, having got our base-line, Dr. Collie continued it last year right away up to the headwaters of the Athabasca. I must say we had, besides photographic apparatus, compasses, and so forth, and Dr. Collie carried with him his portable mercurial barometer, which he invented, and which was described by him in the Society's *Journal* (vol. x., 1897, p. 203).

About the exploits of Wilson I would like to say something. Wilson was originally employed by the Railway surveyors in 1881, and the story he tells is this; it is worthy of record in the journals of this Society. In 1881 four parties under Major A. B. Rogers were in the mountains. One, under C. Miles, was sent up the Kanaskis; another, under McMillan, up the Simpson pass; another, under C. Lett, up the Kicking Horse; another, under Sproat, which Wilson joined, was deputed to survey the Bow. Not much result came from that year's work, as the parties got away too late, and were ordered back early in October to return to Winnipeg. In the following spring, 1882, four parties were out again. Major Hurd, an assistant to Major Rogers, did excellent work, and it is the opinion of Wilson that had his route been followed, the company would not be having the "washouts" and delays the railway is now subject to. All the parties in 1882 were put to work on the Bow and Kicking Horse and the Columbia valleys, and in the autumn, one in the Selkirks. Major Rogers was satisfied with the reports of all the passes, with the exception of the Bow and the Howse pass, and ordered Wilson to go through alone on foot. He accordingly started on foot from where Laggan now is, making good time to the valley of the Little Fork, where, finding the torrents very much swollen, he was unable to cross and recross the river as occasion usually arises, when horses are taken with the party. Eventually he succeeded in reaching the Columbia river, at the old Moberley cabins, on the eve of the eleventh day, and there met Major Rogers, who was very uneasy on Wilson's account. He told us that he had eaten his last bannock when in the Blaeberry, and had left pieces of his clothes all along the route, so treacherous is the timber. Wilson has made many excursions into the mountains, but never has carried so "big a load of doubt and so little grub and blankets as on that occasion."

The reports of Captain Palliser and Dr. Hector, both recipients of the Founders' medal, are most delightful reading. Their map is of course, in its details, inaccurate, but it goes to fill up a gap in that great lone land. The work now being carried on by the Topographical Survey of Canada is most excellent. They have a good staff of men; but, as they pointed out to us in Ottawa, the country is so large, that the survey of the mountains must be always the last thing they will take in hand. They have done good work to the south of the line, but in the north it only extends for a very few miles. The rough survey map that was made by the expedition under Prof. Coleman has been fitted to our own. There is one expedition into this country that Dr. Collie did not refer to—that of the Earl of Southesk in 1859. It is very difficult indeed to determine exactly where he was; but, roughly speaking, he must have been in the neighbourhood of the headwaters of the Athabasca, journeying south to the Bow valley in a second parallel valley to the main range. The peculiarity of these valleys is that, instead of being at right angles to the main watershed, they run parallel. We traversed the first valley, and I think the Earl of Southesk must have been in the second valley.

Taking Dr. Hector's reports, and comparing his rate of travel with our own, we compare very unfavourably indeed. It took him two days to do what we did in four, and Dr. Collie has told us that in the upper Saskatchewan he did not make 10 miles in four days. I can only conclude that the trails have fallen into a "bad state of repair," due to forest fires and to the want of Indian hunters and trappers, who no longer find the country as plentiful in game as in former years.

Mr. STUTFIELD: I very much regret Mr. Woolley is not here. I regret it all the more because, after the exhaustive paper by Dr. Collie and Mr. Baker's speech, there is little to say. As you will understand from the paper, we had a most delightful trip, and some very charming climbs. Dr. Collie did not tell you of the ascent of Athabasca peak, the very best climb of the expedition, which I unfortunately missed, having to go after meat for the expedition by myself, because, as you have heard, "the Collie would not go after the sheep." There is one thing I would like to say to you as to the sport, in case any members of the Geographical Society who are keen and ardent sportsmen might think we were living in a sportsmen's paradise. The contrary was the case. I was hunting several days, and kept a good look-out all the time, and except that one single day, which I look on as the luckiest in my life, I never saw any game. If people want sport they must go west. But if there is no game, there is something much better. Splendid mountains and magnificent scenery, new Alps, and a new Switzerland, larger than the old one, and scarcely inferior in beauty of the mountains and the varied charms of lake, forest, and river scenery. But, unfortunately, it is a Switzerland very little visited. At the bottom of Bear creek, where we made a cache of our provisions, is a spot where five large valleys converge, all leading to beautiful mountain scenery. There, I venture to think, in the days to come will be the Grindelwald or the Chamounix of the Canadian Alps, but now it is all "wasting its sweetness on the desert air." It gets no encouragement from the authorities in command. The Canadian Pacific railway people are sending two Swiss guides to Glacier House next year; but, though exceedingly keen business men, they have only just begun to tumble to the commercial value of glaciers. I was talking to a man at Glacier House, British

Columbia, and said to him, "I venture to say that in the course of ten years your glaciers and mountains will bring in a great deal more money than all your gold-mines put together." He looked at me, but said nothing. I think there is a great deal more to be done in opening up the beauties of this scenery than is being done now. I was talking to Sir William Van Horne about it, and he suggested that if one or two of us broke our necks it might be a good advertisement for the country; unfortunately, we did not comply with the suggestion. Out there they look on all climbers, as so many people do at home, as lunatics, but I would point out that the lunatics pay, and they ought to be encouraged. Now, though we are told it is foolish to prophesy, I venture to say that, just as Mr. Leslie Stephen, in that brilliant work which has become a classic, has made familiar to people on this side of the Atlantic the playground of Europe, so Dr. Collie and his predecessors, in their mountaineering in Canada, have opened out the new playground of America. No doubt America has playgrounds of her own—of a sort. Though she has mountains as high, possibly a little higher, than these, they are lacking in surroundings which to us climbers, at any rate, are indispensable—I mean the glories of the eternal snows, and the marvels and mysteries of the upper ice-world. In these things America cannot compete. Therefore I think that Dr. Collie, Mr. Baker, Prof. Dixon, and others, have done excellent service in opening up the country, and I shall always esteem it a privilege to have been allowed to take a small part in the work.

Sir MARTIN CONWAY: I have no special comment to make on this paper. But I should like to ask Dr. Collie one question—why it was necessary for him to go to these mountains last year, when I was otherwise employed; why could he not have waited and taken me with him? It seems to me that the scenery of these mountains, in which he has done so much good work, is amongst the most beautiful mountain scenery it has ever been my good fortune to see reflected on this sheet. The common but erroneous opinion seems to be that all mountain scenery is very much alike; as a matter of fact, there is the widest possible diversity in the character of mountain scenery in different parts of the world. The Alps always seem to me to be the typically beautiful range, where green slopes and forests and lakes, and snowy peaks of all sorts of varied forms, are most beautifully mixed and mingled together. If you wander further a-field, you will find in the Caucasus a range more grandiose, but likewise beautiful, in a somewhat similar style. If you go further to the Himalayas, you will find in them the newly broken edge of the Earth's crust, lifted aloft with its splintered edges. In different parts of Asia you find varieties of that type of mountain, relatively new mountains, the crinkled-up and cracked off edges of the Earth's newly broken crust. In the long range of mountains forming the backbone of North and South America, from the Klondike to Tierra del Fuego, there are many varieties of beautiful mountain scenery. There are in some parts ranges of mountains, elevated by the pressure of the world, and worn down by the action of long-continued ages of frosts, by air, and water. You will find ranges, or rather areas, where the volcanic forces of the interior of the Earth are, or have been, strongly active, and there mountains take a different form, extremely lofty volcanic cones rising out of deserts of absolute barrenness, surrounded by dried-up lakes which have left no trace of their previous wetness save in the flatness of the white saline deposits. Further south comes a region thatched with forest of the densest kind, that I was reminded of to-night by the photographs we have seen, where the trees rise out of ruins of tangled remnants of broken trunks deep in moss and sodden with water. Out of these forests rise mountains draped with icy glaciers going down into the sea, and the long mountain range itself finally founders into the Antarctic ocean. You have all this variety—you have mountains in the Arctic, poking their noses out of the great flood of ice, and mountains in the tropics rising out of deserts. Mountains, wherever you find them, have qualities of their own; there is an immense variety of type and of charm, but in all this variety of beauty of mountain scenery, there are no mountains which combine grace and at the same time boldness of form with forest and with water more beautifully, as far as I can judge, than those mountains Mr. Collie so well described to-night, and I can only conclude by saying it is very hard lines that he did not postpone his trip, in order that he might have taken me with him.

The PRESIDENT: We have been reminded by Mr. Baker that Captain Palliser and Dr. James Hector, who may be considered the pioneers of the Canadian Rockies, were recipients of our Royal awards, and I think it must be with great satisfaction that the Fellows of this Society remember that it was due to our urgent and pressing representations that the expedition of Palliser for the discovery of passes over the Rocky mountains was organized and undertaken. Prof. Collie and his companions have very worthily trodden in the steps of these eminent explorers; they have gone over ground which was entirely unmapped; they have ascended mountains and done some magnificent mountaineering, under, as you have heard, very great difficulties; and I am sure you will all wish me to express your thanks to Prof. Collie and his companions for the most interesting paper which he has delivered so admirably to you this evening, illustrated with such beautiful slides.

SOURCES OF THE SASKATCHEWAN.

By WALTER D. WILCOX.

THE Saskatchewan, one of the larger rivers of North America, takes its source in the rugged fastnesses of the Rocky mountains, and flows eastward over the sparsely inhabited plains of southern Canada till it reaches Lake Winnipeg. Save for a rapid at the very mouth, the river is navigable for steamboats about 1000 miles. Strangely enough, its two chief branches come from the same ice-fields in the high Rockies, and, after diverging several hundred miles, unite far out on the rolling plains about 900 miles from their source. The North Saskatchewan and the Bow or South Saskatchewan are, at their point of union, each about the size of the Rhine.

From the Canadian Pacific railroad, the easiest way to reach the headwater tributaries of the Saskatchewan is by ascending the Bow river to its source. My friend, Mr. R. L. Barrett, and I left the station of Laggan on July 12, 1896, bound northward, in the hope of reaching the Athabasca pass and measuring the height of Mount Brown and Mount Hooker. For such an extensive journey, which would require two months to accomplish, we had five saddle-horses and ten pack-horses to carry our provisions and camp necessaries. To manage the horses and arrange our camps, we engaged two skilled packers, Tom Lusk and Fred Stephens, the latter an expert axe-man, and also a cook for the party.

On the third march from civilization we came to the upper Bow lake, which is about 20 miles from the railroad. This lake, though only 4 miles long, has fine surroundings, being closely pressed by grand precipices hung with ice and frequently echoing to the thunder of avalanches, while its indented shores and green forests make it one of the most attractive spots in the Rockies. A muddy stream descends from a glacier beyond the head of the lake and pollutes its clear waters, while a clear trout-brook comes from an upland valley lying to the north-west, and this latter stream is perhaps the true source of the Bow. Up the valley, countless springs and melting snow-banks, with large tracts of swampy land, contribute their waters from every side. The level of the valley rises into a gently sloping plain, the last rivulet is passed, and one stands on the divide overlooking the Little Fork of the Saskatchewan river.

Those who have reached this region have had an opportunity of seeing one of the grandest views that the mountains offer. For to the west are the lofty peaks of the highest range of the Rockies, buried in perpetual snow, and discharging their surplus ice by glaciers in every lateral valley. Deep set amid dark precipices, such a glacier is to be seen west of the pass. From two cavernous ice-tunnels a large stream issues and sweeps in a devious course over a barren gravel wash for a mile or more, till it enters a lake. Then, as the clear stream leaves the lake and winds away to the north-west, it is lost to view, hidden amid deep forests, and only reveals its course here and there, where it expands into some one or other of the many lakes which this valley contains. Between the spurs of the summit range on the west and a parallel range on the east, the great trough or valley which carries the Little Fork and the North Fork of the Saskatchewan draws away in a nearly straight line for more than 60 miles, till its end is lost in the blue haze of distance.

The summit of the pass is a delightful region, situated at an altitude of 6700 feet, or only 300 feet below tree-line. The woodland is consequently rather open, and abounds in meadows, while the spruce trees, many of which must be four or five centuries old, have that symmetrical beauty of form rarely seen where there is less space and light in the crowded forests of the deep valleys.

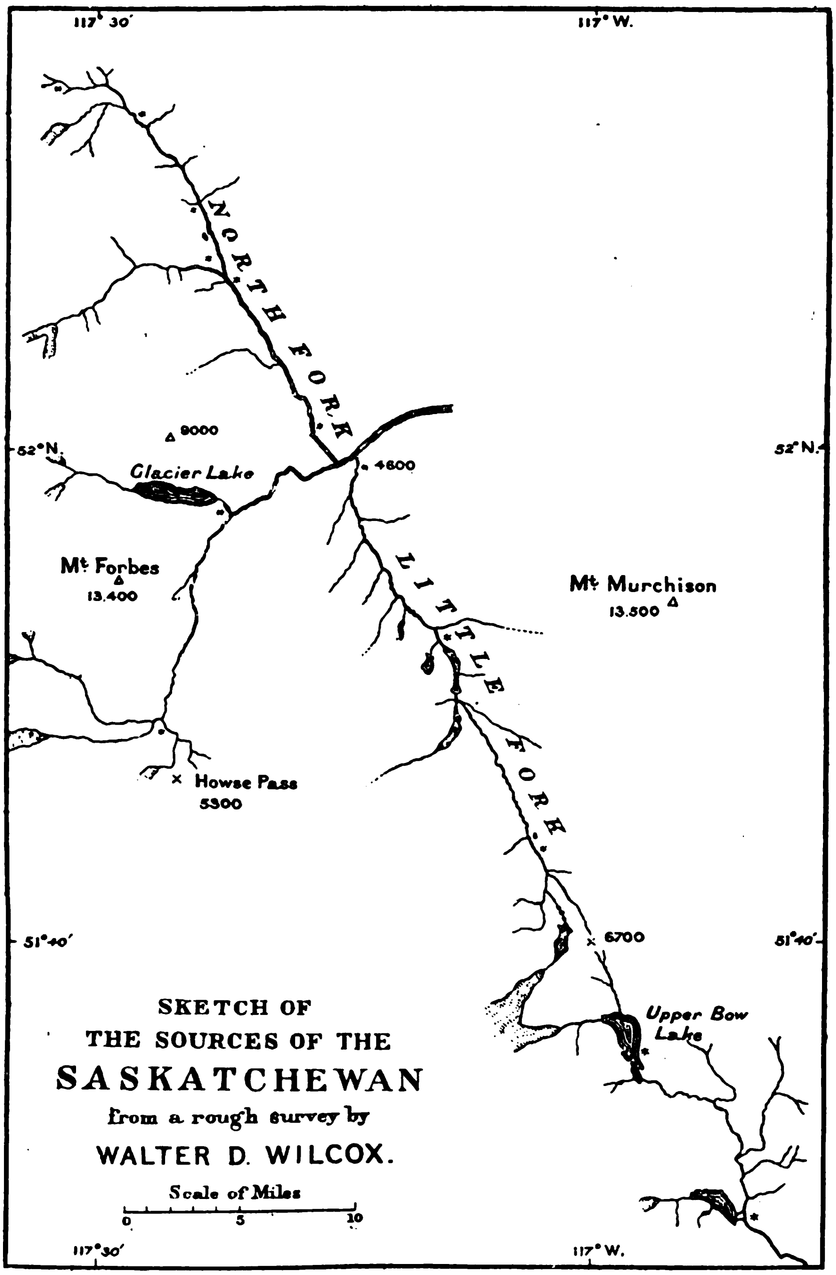
It seemed best to camp on the summit, as a forest fire had broken out in the Little Fork valley some miles distant, and was sweeping furiously up the mountains to the east. Mr. Barrett and one of the packers spent the next day by making a horseback excursion to investigate the extent of the fire and see if there were a way through. They returned in the evening, after a hard day's travel, without having reached the fire. It was evident that the distance had been much underestimated, perhaps owing to the great extent of view from the pass; but it was small comfort to know that the fire was much further off than had been supposed, as we had to change our ideas of its magnitude. As there was nothing to be gained by waiting, we moved a short march into the valley the next day.

The descent into the Little Fork valley is much steeper than on the other side of the pass, and in the first three miles the trail drops about 1000 feet. These mountain trails were used by the Indians at an indefinite period before the whites came into the country. In every important valley, especially where game abounds, there are trails which prove of great value to the traveller.

As our horses were winding through a deep forest, a bird appeared which resembled a pine bullfinch, flitting from tree to tree and following us closely. Somewhat later it gave the most remarkable instance of tameness that I have ever seen. Having followed us for about 2 miles, it waited in a tree during the bustle and confusion of making camp; but during the afternoon, when all was quiet and some of our men were asleep, the bird became exceedingly familiar, and showed no fear to walk on the ground near us, and finally to perch on our extended hands. It was soon evident that the object of our visitor was to catch mosquitoes, which were hovering in swarms around our heads. It pecked at a ring on my hand, at our needles, and in fact any metal article; but the climax was reached when by accident the bird saw its own image in a small looking-glass which lay on the ground. Then, with extended wings and open bill, it uttered cries of rage and pecked madly at the glass where an enemy appeared. Among the solitudes of mountain forests, squirrels, finches, and whiskey-jacks often show a remarkable confidence in man; but this particular instance is noteworthy, because the bird would light on our persons, even after it was momentarily though gently detained several times as a prisoner in my hand.

Further investigation showed that it was possible to get our horses through the fire, which had spent its energy on a large extent of green timber. So, after three hours' travel from camp, we came to the burning trees where the fire was advancing slowly, as there was a calm. Then came several miles of the recently burnt area, now changed to a forest of blackened sticks, some of which were already fallen, with here and there a column of smoke rising from smouldering moss, and everything half concealed in a snowy covering of ashes. At the other edge of the fire there was more danger, and frequently some tree would flash up and send a scorching heat towards us. We were chiefly anxious that the packs should not take fire and cause a stampede among the horses, so for a considerable distance we drove our animals along the edge of a lake, and frequently waded deep in the water to avoid the heat of blazing trees.

After an exhausting march of six hours, we made our camp in a muskeg or swamp, about half a mile from the fire. The wind, however, which had been increasing for a time, began to carry the fire towards



SKETCH OF
THE SOURCES OF THE
SASKATCHEWAN
from a rough survey by
WALTER D. WILCOX.

us, and our situation soon became alarming when some heavy timber began to blaze, and the columns of flame, shooting hundreds of feet into the air, made a terrifying roar, which caused our horses to stop feeding. At one time a funnel-shaped whirlwind about 200 feet high formed over the heated area and remained there a few moments.

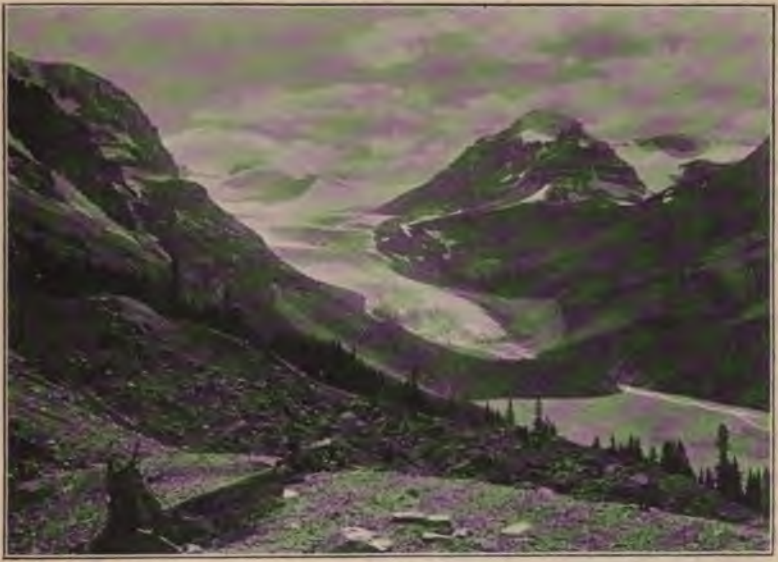
At the rate of progress the fire was making, we should soon have been surrounded had we not packed up and moved a mile further down the valley. The second camp was made by the side of a considerable stream, wide enough to stop the fire. But towards evening cloud-banners began to form at the peaks of the mountains, and in the early morning, after many weeks of drought, it began to rain. Rain fell steadily for ten hours, and fortunately extinguished, for a time, the fires that were destroying this beautiful valley.

We were now two days' journey down the Little Fork valley, a distance of about 18 miles in a straight line. We remained in camp the next day, to do a little survey work from a mountain to the east. From this point, at an altitude of 8000 feet, the Little Fork valley appears straight, deep, and comparatively narrow, with a number of lateral valleys coming in from the west side, and cutting the mountain masses into projecting spurs. The strata of the mountains are for the most part nearly horizontal, and the cliffs are frequently almost vertical. There were six lakes in view from our survey point, of which two, each about a mile long, were merely expansions of the river; three were in lateral valleys; and one lay far up the valley where the river takes its source. The lateral valleys head in the summit range to the west, and have probably never been visited.

The scenery is very grand near the lakes. A striking peak about 10,000 feet in height, with a precipitous rock face and wedge-shaped summit, stands guardian over these lakes, and together with the jagged mountain near it helps to give a gloomy fiord-like appearance to the region. Mount Murchison is supposed to lie in a group of mountains to the east of this place, and, as seen from the Pipestone pass by Dr. Hector, was estimated to be 13,600 feet high. It has never been seen from the Little Fork valley, though it cannot be more than 10 miles distant.

On July 22, we marched six hours and reached the Saskatchewan river. The trail is very good, and runs for many miles through forests which are of splendid timber, especially in the great valley of the Saskatchewan. At the forks or junction the Saskatchewan is a rapid stream about 150 yards wide, and apparently quite deep, and the pure blue waters of the Little Fork are soon lost to view in the muddy volume of the main river. The Saskatchewan valley is about 4 miles wide at this point, the river itself flowing between bluffs of glacial drift, and while the massive mountains on every side are between 10,000 and 12,000 feet high, they are less imposing than usual because of their distance. The main river runs about north-east, cutting through the mountain ranges, and taking its source to the south-west among the highest glacier-bearing peaks of the summit range.

A very large tributary, which we came to call the "North Fork," comes in from the north-west, and joins the main river about one mile above the Little Fork. This river is not correctly placed on Palliser's map; nor was there any available information about the region whence it comes. Even the Stony Indians who travel through these mountains know little of this river, because it is said that many years ago one of their tribe was lost while hunting in that region, and they think he was destroyed by an evil spirit dwelling there. At all events, they will not take chances in visiting that part of the country now.



SOURCE OF THE LITTLE FORK OF THE SASKATCHEWAN.

Our route to the Athabasca, however, lay up this river, and our first duty was to find a ford across the Saskatchewan. A day was spent in finding a safe place, as the river was in summer flood, though not at its highest stage. Mr. Barrett, with characteristic energy, discovered a ford about one mile up-stream, where the river spreads out among low sand islands to the width of nearly half a mile.

A sense of relief came when, on the next day, after fording the turbulent Little Fork, we had crossed the main river, which is of great size at this point, only 30 miles from its most distant source, and were safely on the north side of the Saskatchewan. Turning northwards along a high bluff, we came in a short time to the North Fork, which appears to equal the so-called Middle Fork or main river. About one mile above its mouth the North Fork flows between rocky banks, and there is a fall or rapid in a constricted channel blocked by immense masses of fallen cliff, where the water surges in foaming breakers and dark whirlpools. For a mile or so above this fall there is a fine trail through a light pine forest, and then comes a burnt area with trees crossed in such confusion that it required two hours to make half a mile, and we were so much delayed here that our progress for the day could not have been more than 3 miles in nearly six hours.

On the following two days we advanced about 10 miles up the valley, having a trail wherever there were green forests, but suffering much delay from burnt timber and muskegs. On one occasion, when marching along a steep bank of the river, a pack-horse stumbled among loose logs and rolled over into a deep pool. This was one of our strongest animals, and was carrying over two hundred pounds of flour, a burden that kept the poor beast for a short time at the bottom of the river, but after some violent struggles the horse came right side up and climbed out. No damage was done, however, as flour only absorbs water to a slight depth, and very soon makes an impervious layer on the outside.

Ten miles up the river a stream comes in from the west and unites with the other. As these two streams were about equal in size, we were at a loss which one to follow in order to reach the Athabasca. In order to get a more extended view of the country, an ascent was made of a mountain which lies between the two rivers. On the summit, at an altitude of 3400 feet, it was seen that the western stream takes its source in a large glacier about 12 miles distant. A fair idea of the branch streams was given by the valley openings, but it must be confessed that less is known about this river than of any other source of the Saskatchewan under discussion. As a result of this ascent, we were firm in the belief that our route did not lie up the western branch. The other valley, however, seemed exceedingly deep and like a canyon in the very short distance that it was visible at all. Though the air was smoky from forest fires in spite of considerable rainy weather of late, I tried some photographic work, and during a brief but fatal moment when I was reaching for a plate-holder, the strong wind blew my camera over and broke it badly on rough limestone rocks. The most fragile parts, the ground glass and lens, fortunately escaped, while the wood and brass work were in pieces. With a tool-box carried for such emergencies, the camera was reconstructed after a few hours' labour, and did excellent work later in the trip. Our men returned in the evening, and reported that there was a trail in the deep valley to the north-west.

The next two days we only advanced about 10 miles, because of the uncertainty of the trails, the rough nature of the forests, and repeated crossings of the river. This slow progress was made in spite of our custom to have one or two men explore and cut out the trail for the next day as far as possible each afternoon. In this place the river is at the bottom of a narrow valley, the sides of which are smooth precipices adorned here and there by clumps of trees clinging to the ledges. Streams and springs from far above come down in delicate curtains of spray or graceful waterfalls wafted from side to side by every breeze. The flood of glacial waters sweeps over a gravel-wash in a network of channels, with the main body of water swinging from one side to another of the valley and washing against steep or inaccessible banks. This condition of things caused us to cross and recross the stream almost constantly, and though the fords were in general not more than 3 feet deep, the icy waters ran with such force that our crossings were not without excitement. In spite of the best judgment and care of our packers, some horses got beyond their depth several times and had to swim across. As the saddle-horses are guided by riders, they rarely lose their footing; but the pack-animals coming along in a bunch, confused by the shouting of the men and the roar of the rapids, hesitate, and often enter the river a little above or below the best ford, and so get into deep water. Dangerous rapids or a log jam below make such occasions critical, not alone for the safety of the horses, but even for the success of an expedition, in case a large quantity of provisions are lost. Pack-horses cannot swim very far with their tight cinches, and, moreover, the icy water of these mountain streams paralyzes their muscles very quickly.

SWAMP IN THE LITTLE FISH VALLEY.

The trail at length leaves the river and makes a rapid ascent through forests on the east side of the valley, so that in an hour we had gained 1000 feet. Through the trees we caught glimpses of magnificent scenery, the uniting streams in the canyon bottom, the mountain-sides heavily timbered or rising into snow-summits, and to the west an immense glacier, which was the source of the largest stream. The North Fork was rapidly dividing into its ultimate tributaries. The sound of mountain streams falling in cascades, the picturesque train of horses, each animal cautiously picking a safe passage along the rocky pathway, the splendid trees around us, our great height, and the tremendous grandeur of the mountain scenery, all helped to make our surroundings most enjoyable. Above the sound of wind in the forest there was presently heard the roar of a waterfall, and half a mile beyond we saw a large stream apparently bursting from the top of a fine precipice and falling in one magnificent leap down a great height. Through a notch in the mountains there was another fall visible some miles distant, fully twice as high as the one near us. It was learned later that every stream descended into the canyon by a fall and a succession of cascades.

We camped in a beautiful wooded valley with much open country, at an altitude of 6300 feet above the sea. Near our tents was the river, which at this place is a comparatively small stream of crystal-clear water. In the afternoon, with one of the men, I ascended a small mountain which lay to the west of our camp. From this summit two passes were visible, one 5 miles to the north, and the other more distant and towards the north-west. The view west was more extended. There was a large straight glacier directly before us, the one we had seen earlier in the day, and which supplies the greater part of the water of the North Fork. This glacier is visible at least 6 or 7 miles, but it may extend much further behind the intervening mountains. The glacier has no terminal moraine, and slopes down by a very even grade to a thin knife-like edge where it terminates.

The next day Mr. Barrett went off to climb if possible a high mountain, over 11,000 feet in altitude, north of our camp, while one of the packers and I started to explore the pass to the north-west. The other packer spent part of the day investigating the other pass. This division of labour was a great saving in time. At our conference in the evening, which did not occur till midnight, when the last member came into camp, it was decided that the pass to the north seemed unfavourable as a route to the Athabasca. Mr. Barrett had failed in his ascent, because the mountain was more distant than it appeared. The pass to the north-west seemed more favourable, and on the next day we moved our camp so as to be almost on the summit. The last and longest branch of the North Fork comes from a small glacial lake on one side of a meadow-like summit and at the base of a splendid mountain, a complex mass of rocky *arêtes* and hanging glaciers.

Upon further inquiry, we learned that the valley as it descended to the north-west was blocked by a glacier that came into it, and beyond that a canyon, which made this route altogether out of the question. A high valley on the right, however, offered the last and only escape for us, and, after reaching an altitude of 8000 feet, our descent began into a valley that we knew must be either the Athabasca or Whirlpool river, which flows into it. Thus the most critical part of our expedition, the discovery of a pass from the Saskatchewan into the Athabasca, was safely accomplished. It is highly probable that ours is the first party to go over this route. Though now twenty-six days out from Laggan, we were only a little more than halfway to the Athabasca pass, but a description of that country would carry us beyond the subject in hand.

CAMP SCENE IN CANYON OF NORTH FORK.

Owing to force of circumstances, it was not till late in the season of 1898 that I had an opportunity to visit the source of the Middle Fork of the Saskatchewan. For this trip I engaged as packer William Peyto, a man who had proved very efficient on previous expeditions; also a cook, and an outfit of nine horses.

It seemed almost foolhardy, when on October 12, against driving snow-showers and a cold wind, we set out from Laggan and once more pursued our toilsome march through the many miles of burnt timber northwards, as it were, into the very teeth of winter. Through constant snowstorms—for the headwaters of the Bow are a breeding-place for bad weather—we passed the upper Bow lake, the divide beyond, and got 6 miles down the Little Fork on the third day, as a result of forced marches. During the following night there was a curious creaking sound of the tent-ropes and a sagging of the canvas, and in the morning our prospects for a successful trip were very gloomy indeed, with 10 inches of new snow on the ground. Not wishing, under these circumstances, to get further away from civilization, we remained in camp all day. By afternoon the snow ceased, and the next day we were again on the march. The snow was 15 inches deep in the Little Fork valley, but only half that amount near the Saskatchewan, which we reached on the sixth day.

On October 13 we crossed the Little Fork, and turned westwards into a region that promised to be full of interest. The weather, which had been cloudy and threatening for some days, now gave signs of improvement by the appearance of blue sky in the west, and soon after the high mountains up the Middle Fork were bathed in sunlight. The dazzling light on the snow-covered landscape was very cheering after the days of gloom and storm. The trail penetrates a forest on the south bank, and frequently coming on the river allows views of the wide log-strewn gravel-wash, the work of summer floods.

About 5 miles up the river a valley comes in from Glacier lake, and our camp was placed on a point of land between the confluent streams. The Saskatchewan at this cold season is clear as a mountain spring, and shallow enough to be fordable on foot. In summer, however, it is a raging flood that makes the region of Glacier lake very difficult to reach. From our camp I set out in the afternoon to see the lake, and found it in an hour, not without a hard scramble through deep snow and fallen timber. The view was well worth the labour expended. The lake, which is 3 or 4 miles long, is beautifully set among high peaks, and at the further end a snow-mountain sends down a glacier nearly to its level. The setting sun, sinking into a notch of the distant mountains, poured shafts of light through gray misty clouds and tinged their edges with a pale golden illumination. The lake was nearly calm, and reflected the beautiful picture of mountain and sky from a tremulously moving surface. The water, by retreating from its summer level, had exposed a wide margin of mud-covered boulders and slippery logs, the trunks of trees carried into the lake by snow-slides; but in the distance the forested banks seemed to press close upon the water. There was something wonderfully impressive in the isolation and awful solitude of such a grand scene under the spell of evening calm.

From what had been seen of the country, I decided that it was important to reach, if possible, the summit of a high mountain that lay to the east of the lake, which from its position would command a comprehensive view of the whole region, and also surely reveal Mount Forbes, which was somewhere west of the lake, according to Palliser's map.

Accordingly I was afoot the next morning at nine o'clock, with a camera on shoulders ready for the ascent. The mountain appeared to be about 7800 feet in altitude, or, in round numbers, 3000 feet above our camp. The weather was bright and cold, nor was there a cloud in the sky, and it proved by far the best day of the trip. It appeared that the walking would be better on the other side of the Glacier lake stream, and after some ineffectual attempts to bridge the river by felling trees, Peyto carried me across on his back in a shallow place, and so the climb was commenced with dry boots. In less than five minutes a fine trail appeared, which saved a great deal of labour and considerable time in getting to the lake. The trail at length diverged to the east, towards the mountain, and went in the right direction till the altitude was 600 feet above the lake, at a great saving of energy in forcing a way through the underbush. The sunlight was painfully brilliant on the snow, which was fully a foot in depth at 7000 feet. At this altitude, in a last clump of spruce trees, I hung my camera to a branch and took a short rest, as the climb so far had been very exhausting.

FALL NEAR SOURCE OF NORTH FORK.

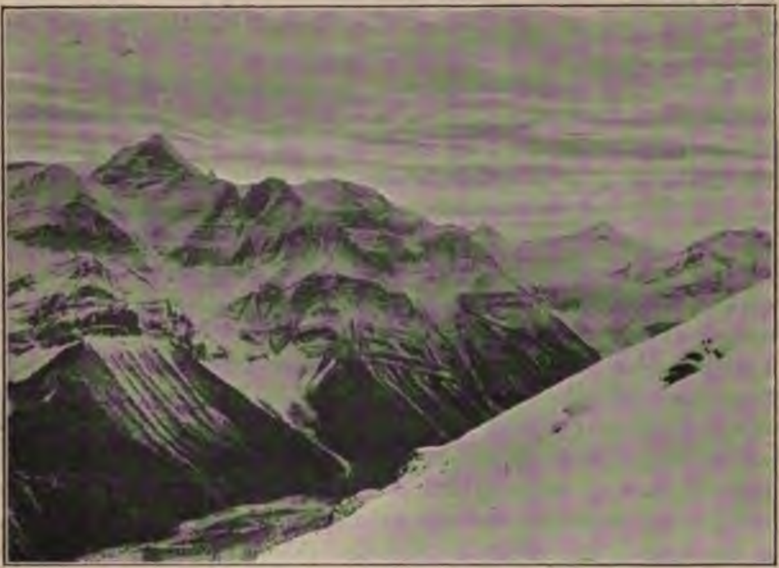
After a pause of ten minutes, the sharp air urged a recommencement of the ascent. The brilliant glare of an hour previous had given place to a somewhat cloudy sky, as a belt of heavy cirrus was drifting along over the mountains in a great line running north and south. The sun shone through it feebly, and was surrounded by a halo. I soon began to have doubts of my ability to succeed in the ascent, as my strength began to fail under so much exertion in the deep snow. The bushes, rocks, and other inequalities of the ground were buried, so that I frequently stumbled and fell. Moreover, it now became apparent that the size of the mountain had been much underestimated, for the heights on the right rose tremendously even after an altitude of 7500 feet had been reached. The inclination was very steep, and the now returned sun on the vast expanse of snow, and the great height above anything to fasten the eyes upon for relief, gave a curious sensation of dizziness, due perhaps in part to exhaustion. I felt, however, the importance of reaching the summit, as it meant practically the success of the entire trip. Moreover, the extraordinarily fine weather on this the critical day of the trip seemed too providential to be lost from any lack of exertion or ambition.

Summoning, then, all my resolution, I made reasonable progress for a time, but soon, in spite of every eager desire for success and ambition to reach the summit, the contest between will-power and tired muscles became doubtful, as the snow grew deeper with higher altitude, the slope steeper, and the far-off summit seemed no nearer than ever. Every few yards of progress was invariably terminated by a fall in the snow, and it seemed better to rest for a moment in whatever position chance had it, than to get up at once.

A little later a view appeared that in itself well repaid the labour of the climb. On the right was an expanse of spotless snow, exceedingly steep, vast in extent, and dazzling in brilliancy. Its rounded contours were sharply outlined against the sky, but there was neither any interruption of stone or cliff in the monotonous covering of snow, nor any scale by which to judge of size or distance. The chief object of interest in the view was a snowy triangular peak covered with ice which now began to appear in the west. The colours of rocks and cliffs in the distant rocks and precipices seemed absolutely black in contrast with the remarkable whiteness of the snow surface on all sides. Overhead the sky was intensely blue, but marked by distinct wisps of white cirrus cloud, spun out like tufts of cotton into shreds and curving lines.

At an altitude of 8800 feet, or more than 4000 feet above our camp, I reached at length the summit of the mountain crest. It was necessary to walk along the crest a quarter of a mile to reach a somewhat higher point, which was the true summit. The snow along this mountain ridge was in many places 3 or 4 feet deep, and, mindful of the terrible alpine accidents caused by cornices, I kept well away from the edge, below which it seemed to drop sheer several thousand feet. The snow was sparkling in the sun, and of the myriads of bright points about one-half were merely white light, like diamonds, the other half were either green, blue, or amber-coloured, like emeralds, sapphires, and topazes. From intense frost my gloves were frozen so stiff that notes and sketches had to be done with bare hands.

The most conspicuous and interesting part of the whole vast panorama was the lofty summit of Mount Forbes, beyond the valley of Glacier lake. Another mountain, about 10 miles to the west, and Mount Forbes were the two highest mountains in sight, and each are probably between 13,000 and 14,000 feet in altitude. Glaciers of very large size come from those mountains and terminate a few miles above the lake. The whole valley of the Saskatchewan to its upper end, and in the opposite direction many miles below the mouths of the North and Little Forks, was clearly visible. There was a very high rock peak in a group of mountains east of the Little Fork that occupied the position of Hector's Mount Murchison, which he calculated to be 13,600 feet high. This mountain is hidden away in a group that must be 75 miles in circumference, and so it is rarely seen. There was a fine view to the north, where a wild and desolate valley thousands of feet below was dominated by a castle-like mountain over 11,000 feet high, probably Mount Lyell, cut in ruins like ancient towers and battlements. Of four plates



MOUNT FORBES, FROM ABOUT 9000 FEET.

exposed on this mountain, only one was successful, so that I had a narrow escape from failing altogether in getting a view of Mount Forbes, which, because of its great height, is veiled from view by clouds, and is frequently invisible for weeks at a time.

Thursday, October 20.—The day broke grey and unsettled, with the highest mountains touched by clouds. We continued our march up the Saskatchewan valley, and urged the horses rapidly over a level gravel plain at such speed as to make in all 10 miles. On the west side of the valley there is a stupendous wall of rock between 11,000 and 12,000 feet high, which terminates in the giant peak of Mount Forbes a little to the north. About 4 miles from our camping-place there is a group of curious rounded hills, rising like forested islands from the sea of gravel.

There was a strong raw wind against us, and, because of our water-soaked boots half frozen by contact with snow, it was altogether too cold to keep the saddle long, and every one walked most of the time. We made camp in a miserable place of stunted timber, half killed by gravel which had been washed over the region in some change of the river course not many years before. The river here divides into three streams: the smallest near our camp came from the Howse pass, less than 3 miles distant; the other two from a valley to the south-east, each, curiously enough, on opposite sides of a flat. In the afternoon, I walked some 3 miles up the valley to where the lesser stream turns in from the west, and, as it heads at the base of Mount Forbes, I followed it a mile or so further, till presently the current became rapid, the valley narrow, and the water closely hemmed in by rocky banks, so that the walking was very difficult. The snow was a foot deep in this little valley, where the sun and wind could not exert their influence as in the open. The stream on the other side of the valley is larger, and comes from a glacier several miles distant. This whole region was very thoroughly examined last summer by Messrs. Collie, Baker, and Stutfield, who not only explored the large glacier, which is supposed to be 10 or 15 miles long, but went up the other stream several miles to the base of Mount Forbes, in the hope of ascending it. The flood of waters that sweeps down here in summer from the long glacier has cut channels 3 or 4 feet deep, lined with immense boulders, across the whole bottom of the valley. This is the chief stream or source of the Saskatchewan.

During the night the wind came up in fitful gusts, the stars were no longer bright points, but foggy spots seen through a thin mist, bands of cloud swept along the mountain-sides almost as low as our camp, and at length the whole sky was overcast. The barometer was much lower at midnight. By one in the morning it began to snow, which was a cause for no little apprehension, as we were far from the railroad.

Friday, October 21.—The sky was still threatening, though very little snow had fallen. We were on march a little after ten o'clock, and reached the summit of the Howse pass in an hour. This pass was made known to the traders of the North-West Fur Company by a man named Howes, or Hawes, about 1810, and was at one time much used by the Kootenay Indians, who came over the mountains and bartered with the fur-traders at a place about three days' journey down the Saskatchewan, now known from this circumstance as the Kootenay plain. This route is now impassable, as fire has run through the forests in the lower part of the Blaeberry valley, which leads to the Columbia river, and the timber has fallen for many miles. The pass itself is about 5300 feet in altitude, and about 18 miles from the Little Fork.

WINTER SCENE ON PASS BETWEEN BLAEBERRY AND KICKING HORSE RIVER.

At this point we were seven days' journey from the railroad by either one of two routes—the one we had come by, or another which, by going down the Blaeberry a day's march and then over a pass to the southeast, would bring us to a pass into the Kicking Horse river, and so to Field, in British Columbia, and the latter route seemed preferable, as it would be through a new region.

The descent into the Blaeberry is one of the most trying exploits that the mountains offer. We commenced to descend rapidly the channel of a brawling mountain torrent, crossing from side to side constantly, so that our horses were compelled to climb up and down steep banks, to scramble over immense logs, or sometimes to force a way down the bowlder-strewn bed of the river. As there was no trail, Peyto had to lead in whatever way appeared best, and in several places our horses had to slide on their haunches down steep banks 40 or 50 feet high, jump into the torrent, cross it, and then ascend a similar bank on the other side at the greatest risk of accident, and to the no little trial of our nerves. After three hours of such labour we camped about 10 miles down the valley. It rained hard all night, turning to snow in the morning.

Saturday, October 22.—We followed a branch stream that comes in from the south-east for a mile or so, and then ascended 2600 feet without a trail through a heavy forest. The snow, which was hardly apparent in the Blaeberry valley, became 18 inches deep near the tree-line. Snow also fell at frequent intervals throughout the day and shut out the landscape, so that our bearings were mostly by compass. Almost at nightfall, and in desperation, we camped in the depths of a heavy forest on the mountain-side. The snow was very deep and the temperature low, so that it was all the harder for our horses, which had to be turned loose in the timber with no chance to feed. The heavily laden spruce trees sent down avalanches of snow at every stroke of the axe, so it was very difficult to keep our camp fire going, which was the more important as we had no other water except by melting snow.

Sunday, October 23.—The weather was still cold and threatening. It was very hard work packing up, as all the ropes, canvas covers, tents, and blankets were frozen stiff and covered with granular ice. Our horses looked very thin after their recent hard marches and little or no feed. They were hungry enough to bite off twigs and woody branches from the bushes which had a few buds on them. We did not get off till nearly noon, and then continued a traverse of the forested mountain-side with a constant gradual descent, in the hope of reaching a valley bottom that leads to the pass. We were no sooner started than a heavy snow-storm set in, shutting out everything from view. There was no trail, as the pass has never been used before this summer. In about two hours we reached a valley bottom that we supposed to be the right one, though Peyto, who had taken the only other party through that ever crossed this pass, did not recognize it for some time. The deep snow and the constant ascent were very trying to our famished horses. One or two of us went ahead all the time and broke trail for them, but in spite of this, some of our pack-animals lay down in the snow exhausted and groaned pitifully. We reached the summit at length, and camped half a mile beyond. The snow was now 24 inches deep on the level, and in the depressions of the ground it was between 3 and 4 feet. At this camp our horses got a little grass by pawing away the snow, a habit that they learn during the hard winters on the plains.

We were now at the head of the North Branch of the Kicking Horse river, and it was practically a constant descent to Field, where we arrived in three days more, after having been out seventeen days. On this excursion every camp but the first was made on snow-covered ground, and there were only three days on which some snow did not fall. No small measure of our success was due to the splendid outfit of horses supplied me by Mr. T. E. Wilson, of Banff, who gave me the pick of his pack-animals. Very much depends on the training and strength of the horses in a rough country, where countless obstacles have to be conquered, fallen trees passed over, swamps and rivers crossed, the close-set mazes of deep forests penetrated, and a pathway carefully selected over the treacherous holes of loose rock-slides. To seize the exact hour or day amid the changes of fickle weather, the veiling smoke of forest fires, blinding snowstorms, that a particular journey or mountain ascent may be accomplished, rests in no small measure on the experience of the pack-horse, and it is a cause for little wonder that the traveller soon learns to take a certain pride in the faithful beasts which do service often at the sacrifice of their lives.

Speaking generally of the headwaters of the Saskatchewan, the valleys are well wooded, the mountains very high for this part of the Rockies, and large areas are covered by snow-fields or glaciers. The general character of the scenery is remarkably imposing, and unfailing in variety of mountain forms so long as the valleys are the point of view. When seen, however, from high summits there is a kind of sameness due to the fact that thousands of mountains are visible in the panorama, all quite uniform in height, among which the higher peaks that are 11,000 or 12,000 feet above sea-level are apparently lost.

All the larger streams come from glaciers, and consequently reach their highest stage during the hottest weather; their waters are turbid with glacial mud, and they undergo a daily rise by day when the sun melts the ice, and a daily fall at night when freezing commences. The region of the Middle Fork, especially near Glacier lake and the base of Mount Forbes, is one of the grandest and most imposing, not only in the Rockies, but possibly in any mountain region of the world, even when seen under gloomy skies and the desolate garb of winter. In this region are some of the highest mountains between Montana and Athabasca pass.

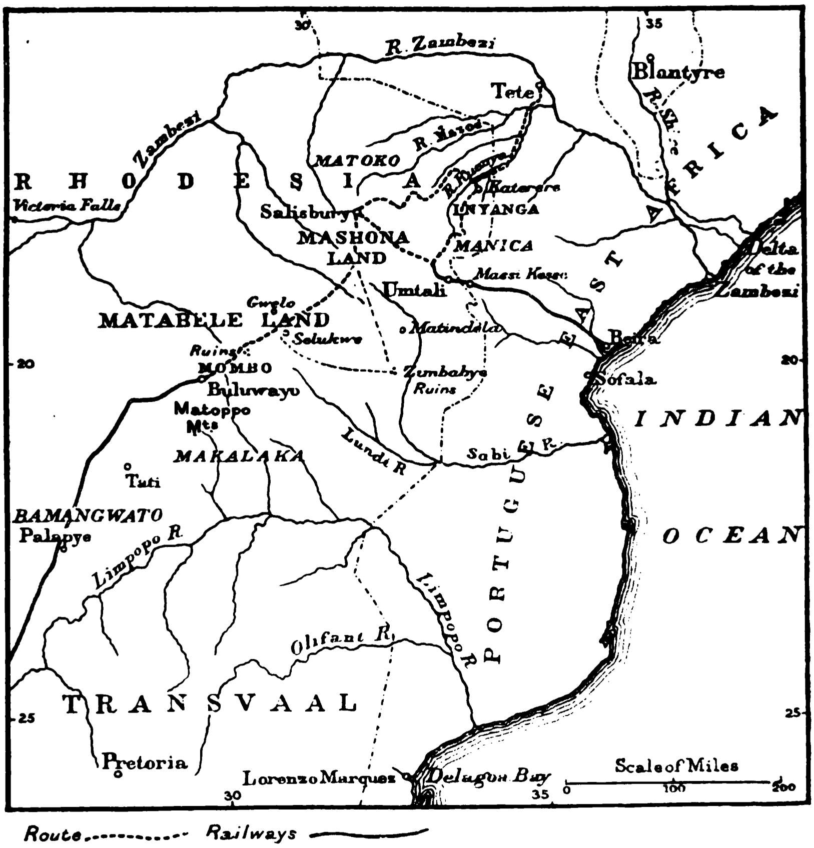
The forests, which clothe all the mountains up to a height of 7000 feet above sea-level, are chiefly of Engelmann's spruce and balsam fir, with occasional areas of jack pine. The beautiful Lyall's larch, characteristic of mountains farther south, was never seen in these valleys.

The summer season, which usually begins in June and lasts till September, is too short for extensive geographical work, so that much remains to be done in the way of exact measurement of mountains and glaciers. However, the very fact that travel among these mountains is still for the most part purely exploratory adds not a little to the pleasure of visiting a region of such unusual grandeur.

TRAVELS AND RESEARCHES IN RHODESIA.*

By HENRY SCHLICHTER, D.Sc.

When I left England a year and a half ago, the principal objects of my expedition were to examine the countries between the Limpopo and the Zambezi, in South-Eastern Africa, with reference to their geological and mineralogical features, their general geographical and ethnological aspects, and last, not least, to examine the mysterious remnants of the ancient colonists, which had been previously investigated by my two predecessors in this respect, viz. Mauch and Bent.



SKETCH-MAP OF MATABELELAND AND MASHONALAND, SHOWING SITES OF RUINS.

My investigations led me right in the centre of Matabeleland and Mashonaland.

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* Read at the Royal Geographical Society, February 27, 1899.

I need hardly describe Bulawayo, as, owing to the opening of the Bulawayo railway, so many reports have appeared in books and periodicals, that everybody is acquainted with this town. But I must add that the railway (the terminus of which Bulawayo is) has in the course of the last fifteen months enormously altered the features of the town. Everywhere large buildings, avenues, etc., are coming into existence, and the activity of the mining districts, especially that of Selukwe, has given, and is still giving from day to day, a stimulus to the inhabitants of Bulawayo, who, in spite of many obstacles, have with British tenacity, for more than five years, upheld their position as one of the furthest and most successful outposts of British civilization.

BAOBAB TREE, INYANGA PLATEAU, NORTH-EASTERN MASHONALAND (ALTITUDE OF 5000 FEET).

You might perhaps ask me to modify this statement, as Salisbury, which is 280 miles further to the north-east, is also a prominent centre of British enterprise, but I must point out that the railway connection with the south is the most important feature which has made Bulawayo what it is to-day. The same will soon be the case with Salisbury, as the indefatigable energy of Mr. Rhodes has already succeeded in pushing the East Coast railway from Beira within close proximity of Salisbury, which town will be reached by it in the course of the present year.

From Salisbury I started for Inyanga. It was due to Mr. Rhodes's kindness, who provided me with an excellent guide, Mr. Pretorius, of Headlands, that I was able to cross from the main road between Salisbury and Umtali through the little-known territory north of Manica to the hardly explored district of Inyanga. Inyanga is decidedly the pearl of Mashonaland. I give my own impression, acquired there and then on the spot during my travels and stays of many weeks. From an agricultural and pastoral point of view these districts are excellent, and their climate is healthy in every respect.

The Inyanga plateaus extend towards the north for not less than 60 miles, whence they slope down to the valley of the Ruenya. I have twice traversed this whole district. Botanically, the mopani and sugar-bush formation further south changes into picturesque grassy plateaus, above which the enormous baobab trees, the giants of the African flora, tower up. I have since learned that this is a novel botanical feature, as so far baobab trees in Central South Africa have not been found in altitudes higher than 3500 feet; but as I marked in detail on my maps where I met them first, and as I have photographs of them, I am in a position to fully substantiate my statement. Moreover, they occur also on the high plateaus of the Matoko country in Regao's district. The lovely plains and valleys of Northern Inyanga are everywhere studded with them, while, wherever black soil appears, the traces of innumerable old negro cultivations, chiefly rice, are noticeable. But, strange to say, these lovely plateaus are in their northern parts entirely uninhabited. I have often queried my black followers with reference to this point. It appears that the reason is twofold. First, owing to the great elevation, the climate is, during the greater part of the year, too bleak for them; and, secondly, they all assert that there was, a considerable time ago, a big battle on these plateaus, and that they are afraid of the ghosts of the slain. The latter assertion is one which has a great influence upon their mind, as none of them, who happen to pass the district, omit to take all the necessary precautions, like stone-throwing, and so on, when they have to go across the dreaded plateaus.

But the district is also in other respects full of interesting relics of bygone times. First of all, there are innumerable old native workings, which indicate that once a very dense population occupied these plateaus. Hills after hills and mountains after mountains are literally covered with stone terraces, wall enclosures, etc., which were partly erected for defensive purposes, and partly because agricultural, or rather horticultural pursuits played a very important part in the mode of living of these Bantu tribes. These old cultivations do not belong to antiquity, and I have little doubt that we have to put them down to the well-known Monomotapa period several centuries ago.

But, apart from that, Inyanga is full of unmistakable indications of a civilization many centuries older, and belonging to the Zimbabye period of antiquity, which is chiefly characterized by the mysterious Mashonaland ruins, concerning which we have had the late Mr. Bent's account seven years ago. There are hundreds of ancient forts and slave-pits, large aqueducts, and many traces of smelting furnaces, and extensive citadels, the last-named being used for defensive purposes against the surrounding mountain tribes.

Indications of the ancient Semitic stone and solar worship are numerous, and in one of the slave-pits of Inyanga I have discovered, on an old soapstone slab, the remnants of an inscription, which is undoubtedly of ancient Semitic origin.

MOUNT MARKHAM, FROM A DISTANCE OF ABOUT 20 MILES.

North of Inyanga these traces of an ancient civilization gradually disappear, but I should not like to leave it unmentioned that a little further west, in a big valley which is formed by the source rivers of the great Ruenya system, not only similar ancient remnants are numerous, but that there are quartz and other indications, proving that an extensive gold industry was carried on in olden times.

On the whole, these Inyanga plateaus are, as I have mentioned, 6000 feet high, but they gradually slope down towards the north, where, in the vicinity of Katerere's district, they descend towards the river system of the large and permanently flowing Ruenya, which runs from there towards the north to the Zambezi.

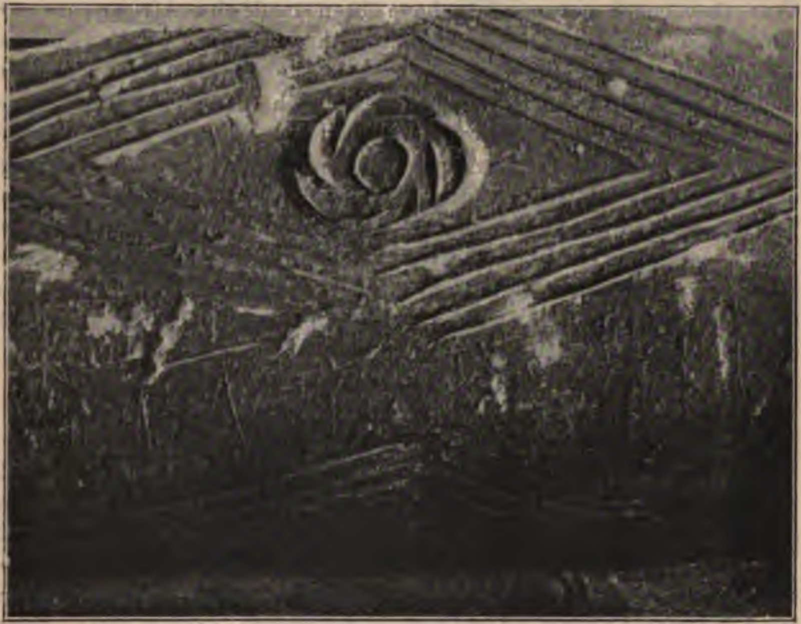
These high plateaus present splendid views over a very extensive part of the still unsufficiently explored country to the west, while towards the east the steep Inyanga mountains rise like an enormous natural wall. While marching through these districts day after day, hundreds of new peaks became visible, some of them of great altitude. There is one spot, 40 miles north of Mr. Rhodes's Inyanga settlement, where one of the most picturesque African panoramas exists. Mauch discovered and named two lofty granite mountains to the north of this spot, and called them Mount Moltke and Mount Bismarck. Both reach an altitude of about 9000 feet from sea-level. Towards the south-west I discovered what seemed to me two still higher mountains, which are, as far as my knowledge goes, without native names, and which I called Mount Markham and Mount Keltie.

Mount Markham is, as the photograph shows, a splendid double-peaked granite mountain; it belongs to the nearer districts of Northern Manica, west of Inyanga. Southward there is another characteristic mountain, also visible from the same spot, and which I passed several times, viz. Mount Umsenia. It is not as high as the other two, but presents a characteristic appearance, owing to its picturesque granite crest, extending over more than a couple of miles.

From Inyanga I went through the Kaiser Wilhelm I. district to Tete, on the Zambezi. The distance is 150 miles. The diagram (p. 376) shows you the course of the Ruenya river, ascertained as far as its junction with the Mazoe. I was greatly interested in finding that, at the junction of the Mazoe with the Ruenya, a large party of the Oceana Company was engaged in successfully washing alluvial gold. Tete itself is in a dilapidated state. The town made upon me the impression of a German town after the Thirty Years' War. There are at present only about twenty Europeans at Tete, and their hospitality is of the best kind.

The natives who occupy the districts north-west of Inyanga are totally different from the Mashonas. They are Matokos (or Mambujas), and a very fine race indeed. Warlike and proud, and many of them more than 6 feet high, they resemble more the Matabele than the degenerated Mashonas, whom they conquered about twenty-five years ago, when they immigrated into the country. This last-named statement I derived from the unpublished diaries of the late explorer, Carl Mauch, which are in my possession. His reports concerning the Matokos are of great interest to me. During the last rebellion the Matokos did not side with the Mashonas, although they share the common dislike of every proud tribe against foreign rule. I personally like these rough savages much better than I do degenerate tribes like the Mashonas and Makalakas. One of the principal reasons why I visited the Matoko country was that I expected to find extensive gold-fields in the formations of the metamorphic schists and those above them, and I may just mention that my expectations were confirmed.

Let us now direct our attention to the important question of ancient colonizations in South Africa. When Mr. Bent returned, in the year 1892, from his journey to Zimbabye, he declared the Mashonaland ruins as buildings dating from a pre-Mohammedan period, and of ancient Semitic origin. A short time afterwards I gave in our *Geographical Journal* a series of reasons that these Mashonaland ruins date not only from a pre-Mohammedan time, but that they must have been built before the commencement of the Christian era. I have at the same time pointed out the astronomical significance of the mural ornaments which are found everywhere on the more important ruins, and I have advocated the possibility that we might be able to ascertain the exact age of these highly interesting buildings by means of them. That was at the time of Bent's journey. Meanwhile the Zimbabye ruins have been further examined by Sir John Willoughby; many other finds have been made by various prospectors (some of the highest importance); and, finally, I have myself personally investigated not less than four of these ancient ruin districts, viz. Zimbabye itself, Manica, Inyanga, and the very important group of ancient ruins in the Mombo district of Matabeleland, which are in many respects even more interesting than Zimbabye itself.



ROUGH SUN IMAGE, CARVED ON DECORATED SOAPSTONE MONOLITH, ZIMBABYE.

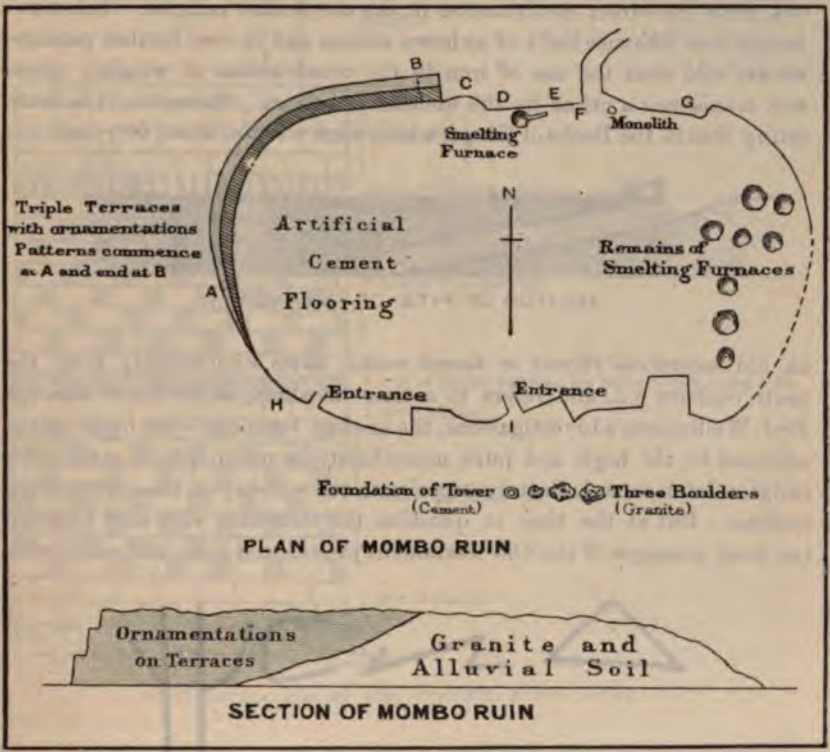
I will now deal with all these factors in the most concise fashion possible. One of the most remarkable finds is the Zimbabye Zodiac, which was found some miles from the Zimbabye ruins, and which is now in the possession of Mr. Rhodes, who was kind enough to let me examine it carefully. I am in a position to show you an excellent photograph of this most interesting document of pre-Christian time, which I have recently taken in Capetown. These zodiacal signs are represented on what I believe to be an offering-dish of very hard wood, which has been well preserved through all the centuries since the ancient colonists used it. The zodiacal pictures are such that they could not possibly have been made by African savages, while they coincide in every respect with other finds which Bent and others have made in Zimbabye. One of the pictures is an image of the sun analogous to the sun-pictures which Mauch and Bent found on the monoliths of Zimbabye, and analogous also to finds in Asia Minor, which belong to the Assyro-Babylonian period. And this image of the sun has its position directly behind the zodiacal image of the Taurus, and between the signs of the Taurus and the Gemini. But we know that in early antiquity the beginning of the year was represented by the zodiacal sign of Taurus. This was so firmly established (although not correct any longer at the later time of the Roman period) that even Virgil still sings—

> "Candidus aureatis aperit cum cornibus annum *taurus*."

Therefore this position of the image of the sun on our Zimbabye Zodiac points directly to the early times of antiquity. But this interesting document furnishes us also with a second proof, because the centre of the offering-dish is represented by a crocodile, which, as Sir Norman Lockyer has proved, was frequently used in antiquity as representing the polar constellation of the northern hemisphere (compare Sir J. Norman Lockyer, 'The Dawn of Astronomy,' 1894, p. 150). Moreover, it is important that to this very day the Matokos show a similar crocodile worship to that which is described in Sir Norman Lockyer's just-mentioned book with reference to the crocodile and the hippopotamus. Furthermore, it is interesting to note that in ancient Egypt the symbol for the commencement of the year was the image of a hawk. This hawk was, as is very well known, likewise the symbol of Ra, the sun-god of the ancient Egyptians; and hawks were also worshipped in Zimbabye, as has been conclusively proved by Mauch, Bent, Posselt, and others.

All these various points show that there was an early connection between the Zimbabye colonists and the races of antiquity which practised solar worship and astronomy. That Zimbabye is of ancient Semitic or Egyptian origin can no longer be doubted, but I have further additional evidence to that effect.

In 1897, when I was at Inyanga, examining the numerous ancient slave-pits there, I was fortunate enough to discover what I believe to be an ancient inscription, of which several letters are still perfectly legible and well incised. It has an archaic and quaint appearance, and I have already mentioned that it is of ancient Semitic origin.


B
C
D
E
F
G
Smelting Furnace
Monolith
N
Triple Terraces with ornamentations Patterns commence at A and end at B
A
Artificial Cement Flooring
Remains of Smelting Furnaces
H
Entrance
Entrance
I
Foundation of Tower (Cement)
Three Boulders (Granite)
PLAN OF MOMBO RUIN
Ornamentations on Terraces
Granite and Alluvial Soil
SECTION OF MOMBO RUIN

CENTRAL MOMBO RUIN.

ORNAMENTS ON TERRACE OF MOMBO RUINS.

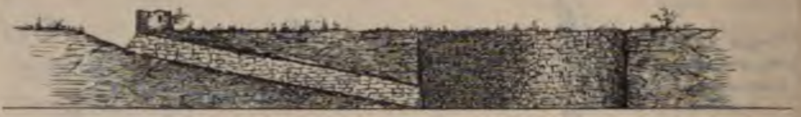
Lowest Terrace.—Chess pattern.
Second ,, .—Zimbabye /\/\/\ pattern (top); single herring-bone (//////) pattern (middle); chess pattern (below).
Upper Terrace.—Single herring-bone pattern (top); Zimbabye pattern (middle); chess pattern (below).

Ornaments at—

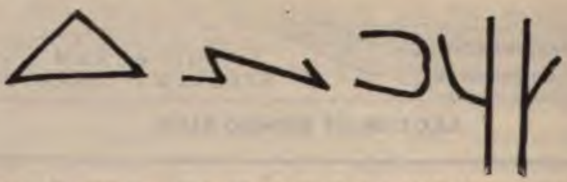
C Chess pattern (top); single herring-bone pattern (middle); double herring-bone pattern (<<<<<<) (below).
D Two parallel rows of dark ironstone.
E One row single herring-bone pattern (\\\\\\) (top); one row double herring-bone pattern (middle); four rows with chess pattern (below).
F A gap.
G Double herring-bone pattern (>>>>>>); eight rows with chess pattern.
H Short double herring-bone pattern.
I Single herring-bone pattern (//////), ironstone pattern, near entrance.

The width from east to west (from terrace to smelting furnaces) is 135 feet; other distances are in the same proportion.

In order to further investigate this problem, I have gone very carefully through the Old Testament, where the much-discussed trade in gold-production, etc., in connection with the mysterious country of Ophir, is described. I was surprised to find that a number of direct analogies between Zimbabye and the early Israelitic worship exist. In the first instance, the treatment of the stones in Zimbabye, without chisels and other iron implements, which Bent and Willoughby pointed out, finds its direct confirmation in the old Judaic religion. Solomon's temple was likewise built of unhewn stones, and in two further passages we are told that the use of iron in the construction of worship places was considered a crime by the ancient Israelites. Moreover, it is interesting that in the Books of Kings, which were written about 600 years B.C. an old sacerdotal rhyme is found which dates undoubtedly from the tenth century B.C., and refers to a time in which, as we know through Prof. Wellhausen's investigations, the ancient Israelites were by no means addicted to the high and pure monotheistic worship which made their religion later on so infinitely superior to the worship of the surrounding nations. But at the time in question the Israelites were still addicted (as many passages of the Old Testament prove) to a solar and astral worship, similar to that of the ancient Egyptians, Phœnicians, and Arabians. This important passage reads (according to Prof. Kautzsch's verbatim translation of the Book of Kings), "Jahweh placed the sun in the firmament of Heaven, but he said that he would dwell in darkness. Now, I have surely built Thee a house to dwell in, a settled place for Thee to abide in for ever." This is a direct analogy to the Zimbabye worship. There we have the same fact, viz. that the worship took place in the interior, and that the sacred enclosure was in the darkest part of the temple.

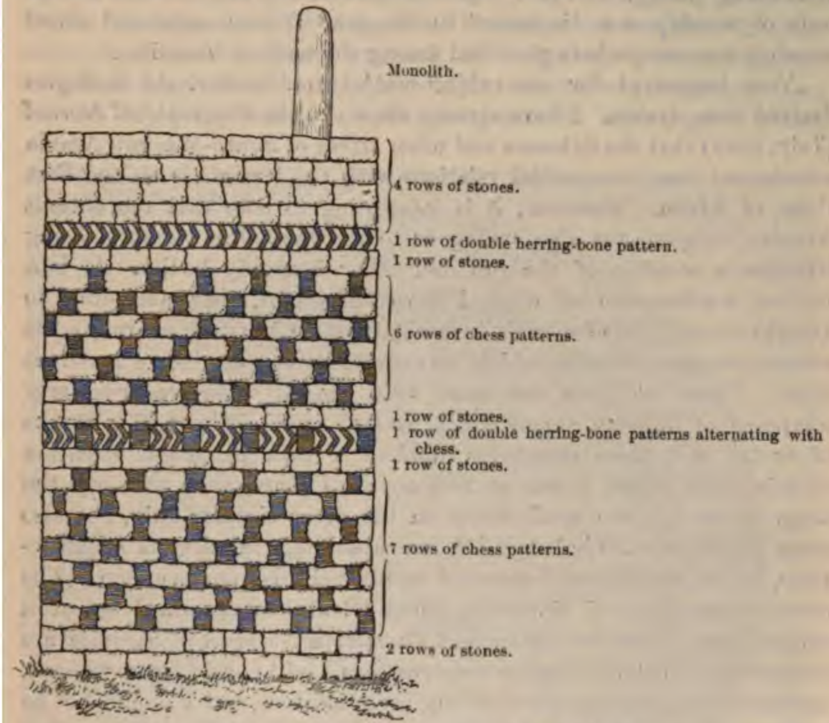


SECTION OF PITS OF INYANCA



SUPPOSED ANCIENT SEMITIC INSCRIPTION FROM A SLAVE-PIT OF INYANGA.
(ACTUAL SIZE).

But this ancient Hebrew sacerdotal rhyme is still more characteristic in another respect. While in the year 600 B.C., when the First Book of Kings was written, this solar worship was still distinctly noticeable, we have the characteristic fact before us that 300 years later, when the Judaic religion was far more advanced and refined, and already in its highest moral development, the "Chronicles" were written, which are, as is well known, more or less a modified copy of the Book of Kings. And there we notice that the first verse of the sacerdotal rhyme just mentioned is suppressed, and that also the reference to the dwelling of Jahweh is modified. This is in complete accordance with the enormous progress of the Judaic religion in the direction of the exalted monotheism which characterizes it. From what I have said, we see that, like many other indications belonging to the same period, the archaic and undeveloped Semitic worship of the Israelites was in close


Monolith.
4 rows of stones.
1 row of double herring-bone pattern.
1 row of stones.
6 rows of chess patterns.
1 row of stones.
1 row of double herring-bone patterns alternating with chess.
1 row of stones.
7 rows of chess patterns.
2 rows of stones.

WALL DECORATIONS AT THE MONOLITH, MOMBO RUINS.

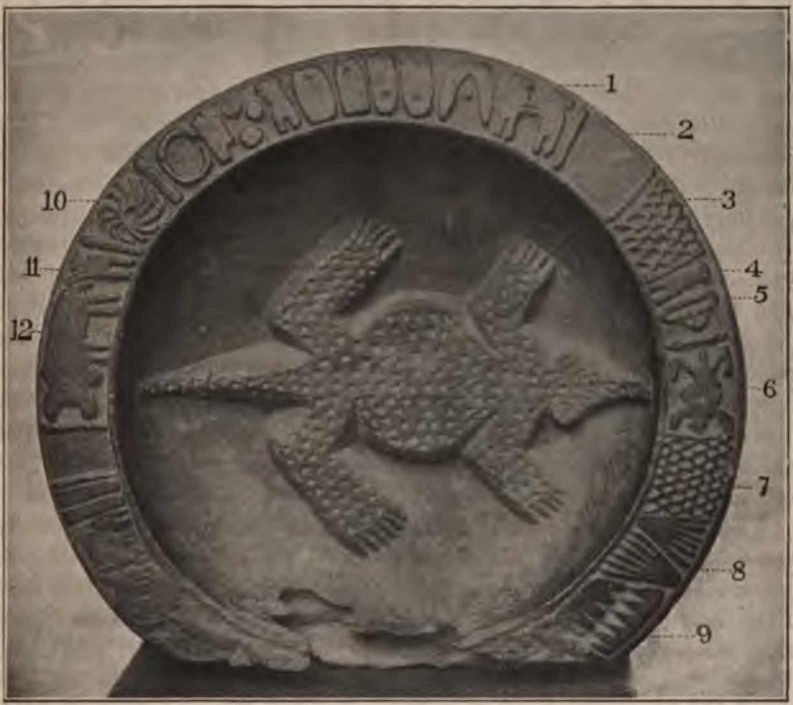
SECTION OF OLD PORTUGUESE FORT, INYANGA.

connection with the solar worship of other members of the great Semitic family, including Phœnicians, Assyrians, Babylonians, etc. The analogy becomes still more interesting to those who believe in Prof. Wellhausen's interesting theory, who is of opinion that before the detailed Judaic code of worship was discovered in the year 623 B.C., solar and astral worship was everywhere practised among the ancient Israelites.

Very important for our subject-matter are, further, the analogies derived from Arabia. I have already shown in the *Geographical Journal* (July, 1893) that the Sabæans and other tribes of South-Western Arabia entertained close commercial relations with the territories on the East Coast of Africa. Moreover, it is interesting to note that the ancient Arabian religion was also analogous to the Zimbabye worship, being likewise a worship of the sun and other heavenly bodies. It is a further confirmation of what I have mentioned, that, according to Doughty's and Pietschmann's investigations, in North-Western Arabia ancient monuments exist which correspond to the Zimbabye constructions. There we have the same solid conical structures regularly composed of unhewn stones which we find at Zimbabye. The Arabs of to-day call these structures Riqûm. I paid particular attention to this point when I was at Zimbabye. I found that not only the large tower and the small tower in the great circular ruin, but also some of those on Zimbabye hill are absolutely analogous constructions. Carl Mauch has discovered another similar construction. The circular remnants of Matindela which Bent has examined are of a similar type. How far the ancient Phœnician Nuragen in Sardinia are connected with the Zimbabye constructions I will not decide at present, as they are beyond the sphere of my investigations, but I should not be surprised if we should find further connecting links; and I remember that the late Mr. Bent, in a discussion on this subject, mentioned to me that he had found something similar in Upper Egypt. Also the late Mr. Phillips, a well-known English trader in Matabeleland, stated, as far as my memory goes, that he found a similar monument more to the west in Matabeleland.

Summing up all these facts, we come to the conclusion that we have a Semitic cult of a very remote time before us. Bent remarks that he nowhere discovered burial-grounds or graves. But I have found, north of Inyanga, what I believe to be an extensive burial-ground. Owing to the absolute want of boys at the time being, I was unfortunately prevented from doing any excavation work thereon. It is a great pity that when, some time back, some prospectors of what is called "The Ancient Ruins Company" found a number of ancient graves and got out of them considerable quantities of gold, they did not keep the human skeletons which they found. Although I took the greatest trouble to ascertain details, I can only state, as far as my information goes, that the skulls were dolichocephalous.

Speaking about the period in which Zimbabye was built, I made on the spot the necessary measurements, which I have already explained in *Petermanns Mittheilungen* in the year 1892. My views, which I shall explain more in detail in a separate essay, were completely confirmed by the measurements. We have in Zimbabye an enormous gnomon before us, comprising a total angle of 120°. Taking all the details into account, I found that the obliquity of the ecliptic was somewhat more than 23° 52′, which brings us (considering that we have a good Chinese observation of the same period) to a time somewhat 1100 B.C. for the erection of the Zimbabye ruins.



ZIMBABYE DISH, SHOWING A NUMBER OF ZODIACAL AND OTHER ASTRONOMICAL SIGNS.

MEASUREMENTS:—Diameter, right to left, 14¾ inches; diameter, top to bottom, 13 inches; outside depth, 5¾ inches; inside depth, near centre, 2¼ inches.

1. Gemini. 2. Empty space standing for Cancer (constellation introduced at a later period of antiquity). 3. Leo (?). 4. Virgo. 5. Libra. 6. Scorpio. 7. Milky Way (Sagittarius). 8. Capricornus (fish-tailed goat). 9. Aquarius. 10. Sun image. 11. Orion (hunter). 12. Taurus. The crocodile is taken to indicate the northern circumpolar constellation (compare Lockyer, "Dawn of Astronomy," 1894, p. 150).

Let us now turn our attention to another important group of ruins. In the middle between Bulawayo and Gwelo, about 15 miles south of the main road, there is situated a group of ancient ruins which represents the Zimbabye of Matabeleland, and which is in several respects even more interesting than that of Mashonaland. These buildings have been visited by prospectors, etc., before me, but no investigation of them has ever been made. In size these ruins (which I call, after the district in which they are situated, the *Mombo* ruins) are somewhat smaller than the Zimbabye temple, but in construction and ornamentation they are superior to it, and far more interesting than Zimbabye.

The Mombo ruins consist of a number of buildings, of which the central corresponds to the circular temple in Zimbabye, while the others are additional enclosures and fortifications. The central building is, from an architectural and astronomical point of view, the most interesting ruin south of the equator. The appearance of it is, as I have mentioned before, similar to the Zimbabye temple, but the difference between the two is (and I know no better comparison) that of an early Romanic basilica of simple feature compared with that of a cathedral of the most refined Gothic period. While we have on the outside wall of the Zimbabye temple only one astronomical pattern, and only a few indications of them on Zimbabye hill, the principal building of the Mombo ruins is literally covered with astronomical ornamentations. In spite of various gaps, I have counted not less than twenty-three different ornamentations of the best workmanship, and on a circular enclosure analogous to that which Mr. Bent has explored on the Lundi river there are another four ornamentations. It would occupy too much space to describe these patterns in detail. It is sufficient to say that among them are a number of ornamentations which I call Zimbabye patterns, because they are identical with the well-known ornamentation on the wall of the great Zimbabye temple.

The length of the central Mombo ruin (as far as the gaps allow to measure it) is 135 feet, and its average width 70 feet, and the whole appearance is (like Zimbabye) that of an ellipse. On the western side of the interior of this building is an extensive artificial platform of the same cement which is found in the interior of Zimbabye, but it has, different from the latter, a much greater elevation, in order to have a perfect view over the surrounding country. The northern portion of this central building is formed by three high terraces, beautifully executed, which abruptly end towards the true north. They are decorated with Zimbabye and other patterns. This arrangement, together with the platform, is analogous to the astronomical ornamentation of Zimbabye and Lundi.

The eastern part of the building consists of a number of smelting-furnaces, of the same cement as the platform. Most of these furnaces are partly destroyed, but I found one which is almost intact. South of the principal building are heaps of rubbish, where remnants of blowpipes, crucibles, and quartz are frequent, which can leave no doubt that gold-production was the object of the furnaces just described. We recognize, therefore, in these Mombo ruins, the identical features which my predecessors and myself have ascertained, viz. (1) solar worship,

(2) fortifications, and (3) gold-production. Moreover, I am fully convinced that the great number of different ornamentations, which the plan shows you, had, apart from solar worship, also to do with the observation of the principal planets and stars, but I was not in a position to spend the time necessary to investigate this point thoroughly.

As the platform from which the observations were taken is at present in a very dilapidated state, and as it will take weeks to mathematically arrange and discern the different patterns, while I had only days at my disposal, I considered it best to make as carefully as I could the plan of the building before you, and I hope that either somebody else or myself will soon be in a position to ascertain all these further details. This will not be difficult, as the Mombo ruins are easily accessible, being only a short distance from the main road between Bulawayo and Gwelo. A police camp is only 8 miles off, and the excellent farm and store of Mr. Rixon, who is known all over Matabeleland, is also in close proximity.

After all that I have explained, I should like to say a few words about the much-discussed question of Ophir. I am well aware that this name has a somewhat mysterious and unscientific sound. But this is unjustified. At the time when Lassen, Gesenius, Petermann, and others, discussed the Ophir question, it was from want of definite details that theories of a somewhat unscientific character were started, thus discrediting to a certain extent, in the course of the years, the whole problem. But nothing is more unjustified, because the basis of the whole Ophir problem, viz. the reports of the Old Testament, are in every respect reliable and well defined, and are, from a scientific point of view, just as good as the reports of Herodotus, Ptolemy, Pliny, and others. My first step in this direction was to examine at what time the various authors of the Old Testament have written their reports about Ophir, because it is evident that, at a time when the word Ophir was in everybody's mouth without any further explanation, the colony of Ophir could not possibly have been a matter of the past. The result is, that all the reports of the Old Testament were written in the period between 600 and 164 B.C.

With this fact we have gained a firm basis for the discussion whether Ophir was in India or Africa. Fortunately, the same period comprises the exploits of the man who first explored India, viz. Alexander the Great. Among his followers were many who would have collected news about a gold-belt in India, provided that the latter was actually existing. But no gold country whatever existed there; on the contrary, all Indian tribes were almost devoid of gold, and Arrianus, our best and most reliable source of information about the campaigns of Alexander the Great, states as emphatically as possible as follows:—

"Alexander and his army have refuted most of the stories in this direction, with the exception of some who have obviously made incorrect statements. It has thus been ascertained that all the Indians through whose territories Alexander and his army marched (and he marched through many of them) have no gold." Therefore it is evident that India cannot possibly be the Ophir of antiquity.

Now, we know that, with regard to Ophir, only the coast countries of the Indian ocean can come into consideration, and Arabia and Equatorial East Africa have been mentioned in connection with the Ophir problem. But against this assumption stands the clear text of the three most reliable and oldest passages of the Old Testament, viz. 1 Kings, chap. ix. verses 26 to 28, and chap. x. verses 11 and 22. It is absolutely unintelligible to me how any one who compares these passages in a literal and critical translation (for instance, that by Prof. Kautsch) can assert that the passage in chap. x. verse 22 does not deal with Ophir, as it is most emphatically stated that we have to deal with a sea navigation which extended to remote countries—in fact, to the end of the then known world, and it is therefore clear that this gold land of antiquity could neither have been on the coast of the Red sea nor on that of Equatorial Africa or Arabia. To what extent, however, the Arabians, especially the Sabæans, were engaged and interested in the trade with Ophir, I have shown in some of my previous publications, and it would lead too far to repeat it here.

Summing up, we have the following facts :—

(1) An inscription of undoubtedly ancient Semitic characters.

(2) Zimbabye was built at about 1100 B.C.

(3) A Phœnician and Judaic trade with Ophir is proved to have been in existence (to take the narrowest limits) between 950 and 850 B.C.

(4) Between 600 and 164 B.C. more than a dozen reports referring to Ophir are in existence in the Old Testament, and Ophir is used in them as a household word.

(5) The fact that Alexander found no gold-belt in India.

(6) Herodotus, during the same period, describes furthest Ethiopia as one of the most extensive gold-producing centres in the ancient world.

These are the facts, and I will on the present occasion abstain from drawing more detailed conclusions.

One thing, however, appears to me to be established beyond doubt, through the investigations of Mauch, Bent, and myself, viz. that the territories known to-day as Southern Rhodesia were, 1000 years before the commencement of the Christian era, a gold-producing country of a large extent, and *colonized by the early Semitic races round the Red Sea, viz. by Jews, Phœnicians, and Western Arabians.* The Rhodesia ruins are the first discovered traces of an "Old World" civilization on the southern hemisphere, and they form, as already Carl Ritter expressed it, one of the most interesting links between ancient and modern geography.

In conclusion, I may refer to three old Portuguese fortifications which I found in the northern part of Inyanga; of one of them I made a detailed plan and measurements. The illustration of the section of this fortification shows that these constructions are totally different from the old Semitic ruins, as well as from the Monomotapa Kafir constructions. The existence of these Portuguese forts proves the correctness of the old Portuguese writers of the sixteenth and seventeenth century, who asserted that the early Portuguese dominions extended far into the interior of South Africa south of the Zambezi.

Before the reading of the paper, the PRESIDENT said: We have this evening with us an old friend, who will not read a paper here for the first time—Dr. Schlichter. That reminds me also how much cause we have to lament the loss of Mr. Theodore Bent, and I am glad to say Dr. Schlichter has just told me that, after going over the ground and examining the ruins discovered, as you will remember, by Mr. Bent not many years ago, he can bear testimony to the accuracy of his work, both as regards observations and measurements, and I think I am not far wrong in saying that it was owing to the interest that he took in a paper by Mr. Bent that Dr. Schlichter resolved to attempt to continue his work by further examinations of this country and the interesting ruins to be found there. I now call upon Dr. Schlichter to read his paper.

After the reading of the paper, the following discussion took place:—

Mr. F. C. SELOUS: I am sure we have all listened to Dr. Schlichter's paper with very great interest, for it dealt with a most fascinating subject, namely, the history of a country which, having been once developed to a certain extent by one of the most energetic peoples of ancient times, subsequently lapsed into a state of barbarism, but is now again, thanks to the energy and enterprise of Cecil Rhodes, once more on the threshold of a further and infinitely greater development. I have always discriminated, in speaking and writing of Rhodesia, between the high and healthy plateaux and the lowlying parts of the country in the valleys of the Zambezi and the Limpopo, and I still adhere to what I have always said, that these high plateaux are as good a country as is to be found in South Africa. Without taking the gold into consideration at all, I believe that these plateaux are suitable for European occupation, and possess a climate in which white men will grow up strong and healthy, and I therefore consider that these portions of Rhodesia have a great future before them. It would be very presumptuous on my part, as I have no scientific knowledge whatever, were I to attempt to criticize any of Dr. Schlichter's views concerning the antiquity of the ancient ruins in Mashonaland; but besides the ancient ruins, he also spoke of certain stone walls, which had been built by the Bantu tribes, whose descendants are now living in the country.

Now, the two principal arts known to the ancient people appear to have been the art of building walls of stone bricks carefully fitted together without mortar, and the art of extracting gold from quartz reefs, and I think it is generally considered that these two arts died out in South-Eastern Africa a very long time ago, at the time when the ancient people who first introduced them into the country are supposed to have been swept off the face of the Earth in some catastrophe—possibly a rising of the aboriginal races, during which they and their civilization died together. But I believe that there is an intimate connection between the Bantu tribes now inhabiting South-Eastern Africa and the ancient Semitic people who first built temples and extracted gold from quartz in that country. Not only did the extraction of gold from quartz not become a lost art a very long time ago, but we have overwhelming evidence that it has been continually practised down to quite recent times by the immediate ancestors of the present Bantu tribes, and was only discontinued on account of the Zulu invasions into Mashonaland, which have taken place during the present century. Old men who accompanied Umziligazi on his first incursion into the country we now call Rhodesia about sixty years ago have repeatedly told me that they found the "Amaholi," as they termed the native inhabitants of the country, working in the "amaguti"—that is, in the deep holes—the old workings which have recently been found by Europeans on quartz reefs all over the country. In 1891, too, Mr. Kock, a prospector, found a bucket and rope made of "machabel" bark, at the bottom of a shaft 120 feet deep on a reef near the Umzweswi river. Articles made of such perishable materials could not have been very old, and they had obviously been used to haul up quartz from the bottom of the shaft. Mr. Kock also found several iron implements at the bottom of this shaft, identical with those used by the natives of Mashonaland at the present day. In 1884, too, I visited, with Mr. S. H. Edwards, the mouth of an old shaft filled up with *débris* in Western Matabeleland. By the side of the shaft was a heap of quartz, which had evidently been burnt and stacked ready for crushing, and by the side of this heap of quartz lay several of the hard round stones with which the natives used to crush it before extracting the gold. The burnt quartz, after having been broken into little pieces, was laid little by little on a large flat stone, and ground fine with a large round stone. The gold was then washed out of it and melted into small ingots in clay crucibles. On opening up the shaft I have just spoken of, we found that in one part the roof had been supported by stout poles of "mapani" wood (the common wood of the country). These poles I examined carefully, and found that they all had their bark on, and showed no sign of great age, and had, moreover, all been chopped with the same kind of narrow-bladed axes which the natives use at the present time. In my own mind I feel sure that work at this mine, and at others in the same district, only ceased about sixty years ago, when the Matabele first invaded the country. But the extraction of gold from quartz was an industry carried on in eastern Mashonaland at a much later date than that. The testimony of Mr. Thomas Baines, the well-known traveller and artist, is incontestable on this point. He found the Mashonas extracting gold from hard quartz reefs in the neighbourhood of Lo Magondi's (about 70 miles north-west of the present town of Salisbury) as late as 1870. You will find a full account of this experience in Mr. Baines's book, the 'Gold Regions of South-East Africa.' To get gold-bearing quartz from a hard reef, the Mashonas first lighted fires against the hard rock, and then perhaps threw water on it, and they were then able to pick out pieces with their little axes. These pieces of quartz were then stacked amongst piles of firewood and roasted, and afterwards the burnt quartz was crushed and the gold washed out of it. Thus you will see that the art of extracting gold from quartz, which was first introduced into South-East Africa by a people of Semitic race—as Dr. Schlichter considers—some three thousand years ago, has endured in that country until quite recent times.

So, too, with the art of building stone walls. That art had gradually deteriorated from the time of the building of the great temple of Zimbabwe, but it was only abandoned quite recently. All over Makoni's and Mangwendi's countries, there is no doubt that the people went on building good stone walls round their villages and terracing the sides of some of the hills—their huts being built on the level terraces—until, in about 1820, their territories were overrun by the Gaza Zulus under Manikos. They then found out that their walls were but an inefficient protection against their fierce and well-organized assailants, and so gradually gave up building them. But there is abundant evidence—though it becomes every day more difficult to obtain—that it was the Zulu and Swazi incursions into the countries lying between the Limpopo and the Zambezi which put an end to the arts of wall-building and extracting gold from quartz in South-East Africa. I have a theory of my own to account for the close connection which I believe undoubtedly exists between the ancient Semitic people who built the temple of Zimbabwe and the present Bantu tribes living in South-East Africa. I imagine that the ancient discoverers of Mashonaland came from some part of Arabia. They were doubtless a race of energetic traders, and, after having made their way into the interior, must have found the country rich in gold and ivory—the two things they were in search of. Having found what they were looking for, they probably formed settlements, and these settlements probably endured a very long time. But there were no P. and O. steamers in those days, nor had the Beira railway been built, so that travelling must have been rough and uncomfortable, so I should fancy that the ancient gold-seekers took none of their own women with them from Arabia, but intermarried very freely with the aboriginal black races of South-East Africa. Should this surmise be correct, there would, in course of time, have been a very considerable infusion of Semitic blood amongst the Bantu tribes, though if all intercourse after a time came to an end between Mashonaland and Arabia, owing to wars or revolutions, the more cultured Semitic people would gradually have become fused and lost amongst the more numerous aboriginal races. That there is a strain of some other blood than the negro in the Bantu peoples, I feel sure. You cannot go into any Bantu village in South-East Africa without noticing the difference of types amongst the people. Some are purely negroid, with thick lips, broad flat noses, and bent shin-bones; whilst others have very well formed heads and limbs, and good—even aquiline—features. And I have noticed that when you see a man in South-East Africa with good features, they are usually correlated with a light-coloured skin, and I take it that the blood of the ancient Semitic people still exists in a much greater quantity among the Bantu people than is generally supposed.

There is not much time, I am afraid, for any further comments. Coming to the present history of Mashonaland, and to show you how unreliable native reports are apt to be, I may mention that, although, according to Dr. Schlichter, Herr Mauch was told by Matoko's people in 1870 that they had only lately invaded the country in which they were then living, and had migrated from the north-west, they told me quite a different story in 1890. In that year I visited Matoko, on behalf of the British South Africa Company, and had many long conversations with him and his sons, and also with many of the elders of his people. They all told me that they and their people had been living in the country—the same district where Mauch found them—from time immemorial, and pointed out to me the sites of many old villages, from which their people had been driven by the Abagaza under their chief Mañkos, in the early part of this century. Now, which version is correct? Personally, I am sure that that told to me is, as there are a great many facts which corroborate it. I quite agree with Dr. Schlichter that the Mambujas (Motoko's people) are, in physical and general appearance, a much finer people than the generality of the tribes living in Mashonaland; but I don't think with him that they are a different race of people. Their language is the same as that spoken by all the non-Zulu peoples of South-East Africa, or, rather, it is one of the many dialects of one main language; nor do they dress differently or use different arms. I look upon them as one of the many small tribes now known generically as Mashonas; but as they were never actually conquered and habitually tyrannized over by any Zulu tribe, they have maintained all their old customs intact, and their independence of bearing.

Dr. Schlichter mentioned that Matoko's people did not take part in the recent rebellion against the white people. But in this they were not singular, for none of the Mashonas living to the south and south-east of Matabeleland, that is, Gutu's people or the tribes ruled over by Chibi, Chilimanzi, and several other chiefs, took any part in the rebellion, except to actively assist the whites against the Matabele. I remember the Rev. Mr. Mackenzie, when speaking of the rebellion, said that the Mashonas must have been most brutally treated by the British South Africa Company, to prefer the rule of the Matabele to that of the whites; but Mr. Mackenzie could never have been correctly informed about the whole history of the rebellion, or he would have known that the greater part of the Mashonas who rebelled—the people of Makoni and Mangwendi, for instance—had never had anything to do with the Matabele, whilst all those Mashona tribes which, having lived along the southern and south-eastern border of Matabeleland, had been constantly subject to the grinding tyranny of the Matabele, not only did not join with that tribe against the white men, but gave their active assistance to the latter. Neither did the Makalakas join the Matabele in the late rebellion, thus showing that, like many of the Mashona tribes, they preferred the rule of the white men to that of Lobengula. I will not now say anything more, as it is getting so late, and there are others who may wish to take part in the discussion.

Mr. Ravenstein: It is so very late, and this is so complicated a question, that I must confine my remarks to a very few words. Dr. Schlichter has placed so many interesting facts before us, that I am sure none of us will go home without having learned something. When these ruins were first heard of three hundred years ago, the Portuguese at once jumped to the conclusion that this must be Ophir, and it must be a source of satisfaction to the spirits of De Barros and others to have their views so confirmed. I will only say to-night we ought to be cautious, for this question of Ophir has already given us a lot of trouble, and it is likely to give more. I certainly hope that, so far as Rhodesia is concerned, all expectations may be realized; but as for the identification of the ruins, that is quite a different matter. It cannot matter the least to Mr. Rhodes, or any one else, whether this is the genuine Ophir or not, so long as the gold is genuine. I will only add that I believe we are a little rash in jumping to the conclusion that a Semitic people must have built those prehistoric structures. The temples, no doubt, pointed to sun-worship and the worship of the linga, and such temples, no doubt, are common enough in Southern Arabia, but they are also common to other parts of the world—they are common more especially in India, and I should like to see the claims of India properly considered in this respect.

We know that succeeding waves of civilization swept across Africa. We know there was a Semitic wave in Africa; Abyssinia proves this, and if that country is not wholly Semitic, the traces of Semitic influence are there and extend far beyond. But down the East Coast, the people of India were certainly before the Arabs, and so were the Malays. We have the Malays in Madagascar, although I don't suggest that they were the builders, but why not the Indians? We know, as a fact, that the Indians had an earlier and better knowledge of the Indian ocean and the East Coast of Africa than either the Greeks or Romans or Arabs. The Indians had very ancient maps, the information on which has been used by the Arabs. They had names for islands which were only known to the Arabs by report.

Colonel Sir Thomas Holdich: It is much too late to enter into any lengthened discussion. There is, however, one question I should like to ask—Why should India be condemned as a country that holds no gold? I have a good many friends who have reason to hope otherwise, and who will consider this a most disturbing assertion. We know that one of the great difficulties with which gold-mining operations in India have to contend, is that there are ancient workings in India in the Wynaad, in the Kolar district, Mysore, and in the basin of the Mahanuddy river, and that these workings are driven so deep that it is difficult to drive any further.

Out of them an immense amount of gold must at one time or another have been extracted, and I believe myself that even before the days of Alexander, to which Dr. Schlichter referred, gold was largely found and used in India. I believe, in fact, although no statement as to the existence of gold is made by any of Alexander's historians, yet that I am geologically correct in saying every single river in the Punjab holds gold, except perhaps the Beas.*

Dr. Schlichter: It is too late to enter into any details now, and I will only say a few words. Mr. Selous is perfectly correct. I was surprised, and did not first believe it possible, that there could be so striking a difference between the Semitic and the purely African types. It is astonishing to see two distinct types, the Semitic and the African, in the same village. With regard to the burnt quartz crushings, I have seen them in various places in Northern Manica, and so I can fully corroborate what Mr. Selous states. As far as the mixed races are concerned, it is a question difficult to decide, as also the question of the connection between the Mashonas and Matokos, and I hope Mr. Selous will kindly excuse my not going into this complicated question now, owing to want of time. Mr. Ravenstein has correctly pointed out that there was always an Arabian intercourse with East Africa, but I think he is not quite correct in saying the old Arabian writers do not refer to Ophir. For instance, I think Masudi, one of the oldest Arabian writers in the ninth or tenth century, distinctly mentions South-East Africa and Sofala or Sophara.

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* Had there been time I should have liked to add the following remarks to the above:—

"The evidences that exist of the mediæval occupation of countries lying between India and Africa by Arabs seem rather to support Dr. Schlichter's contention that the African ruins are of Arabic or Semitic origin. Although I have come across no traces of Arab occupation on the coasts of Persia, or in Makran, that are *clearly* pre-Mohammedan, it is historically certain that the Arabs were present in large numbers, both in Sistan and Makran (probably also in India) long before their invasion of Sind, which took place early in the eighth century A.D. It was the Arab governor of Makran who helped Mahomed Kassim through that country to the Indian frontier, so that the Arabs were probably dominant there by the end of the seventh century. A prominent feature of that invasion was the support of the invading army by the fleet, which conveyed the engines of war to be used against the walls of Debal in the Indian delta. The existence of such a fleet implies that the Arabs had long been navigators of the Eastern seas before that time; indeed, we must reckon many centuries to be necessary for the development of a fleet of that nature. Nor is there any reason to suppose that the Arabs were not as early navigators as the Phœnicians (who appear to have originated on the coast of Arabia) or the Greeks. By the time that Vasco da Gama rounded the Cape, the Arabs were able to take latitude observations by using the astrolabe, and could get their longitude from observations of the moon's eclipse, and they had learnt the use of the compass from the Chinese, whilst they apparently borrowed their system of notation from India. I have always suspected Vasco da Gama of having trusted entirely to Arab pilots to find his way to India. That the Arabs were the first astronomers and the earliest navigators is, I think, also supported by the fact that all the early ocean-going ships of Europe were built on the lines of the Arab 'buggalow;' many of our naval terms are Arabic (such as 'admiral,' 'barge,' 'dinghy,' and even 'jolly-boat'), and the names of the constellations are also Arabic. If the Arabs were not the first navigators, they obviously invented their own system of navigation, and borrowed it from no one. There is absolutely no evidence that I know of supporting the idea that the Indians crossed to Africa from India. The Aryans never were sailors. The Dravidians (notably the Telingas) certainly were, but they went eastward to Burmah and the straits, and formed settlements there, and not in the west. On the other hand, the position of the coast Arab city of Tiz, in Makran (which I have explored), and of others on the south coast of Arabia, almost proves the existence of a very ancient trade along the east coast of Africa, a theory which is certainly strongly supported by the evidence of the 'Periplus of the Erythræan sea,' which is supposed to have been written five centuries before the rise of the prophet in Arabia."—T. H. H.

As far as the Indians are concerned, I doubt whether they navigated the Indian ocean further than the coast of Arabia. There is no record before Hippalus that any one crossed the ocean.

I have no desire to force Ophir into Africa, but I have overwhelming evidence, so far as I can see, against India, and I can assure Sir Thomas Holdich that I have studied all the reports carefully. I have come to the conclusion that all the arguments are in favour of Africa and against India. Of course there remains a third factor, *i.e.* that Ophir was an emporium in the vicinity of the Red Sea, where the commerce all flowed together. Against that we have the distinct words of the Old Testament that it was a long sea-navigation. I hope these arguments will be discussed fully at some time, and if I have contributed something towards bringing the question of Ophir on to a scientific basis, I shall be glad.

The PRESIDENT: This is not the first time that Dr. Schlichter has addressed us. He read a very interesting paper on the names given by Ptolemy on the East Coast of Africa, which led to an animated discussion not a great many years ago, and Fellows of this Society will have seen his writings in the *Journal*, and that he has paid great attention, not only to comparative geography, but also to the photographing of lunar distances, which I believe he has had opportunities of practising himself lately.

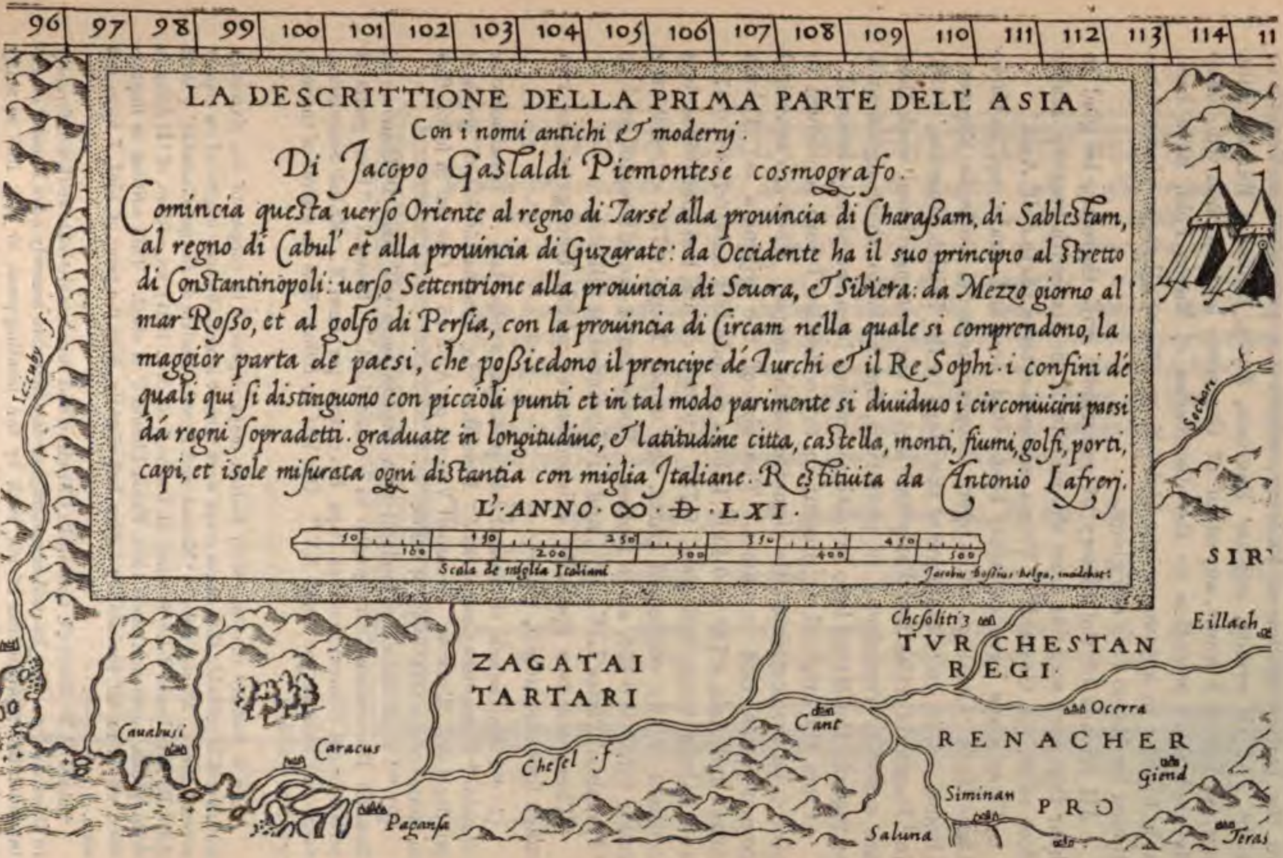
I am sure, as there is no longer any time to discuss the question of Ophir, you will wish me to convey to Dr. Schlichter your unanimous vote of thanks for his very interesting paper and for the illustrations he has shown us.

THE INFLUENCE OF THE 'TRAVELS OF MARCO POLO' ON JACOBO GASTALDI'S MAPS OF ASIA.

By Baron A. E. NORDENSKJÖLD.

AT present about eighty more or less reliable ancient manuscripts are extant of the 'Travels of Marco Polo,' these being in Latin, Italian, or French, and since 1477 numerous editions of the work have been issued in most of the civilized languages of Europe.

Under such circumstances, it might well be imagined that the description of these travels would have exercised considerable influence on the development of cartography, and that both hand-drawn and printed maps of the travels and discoveries of Marco Polo would accompany the many manuscripts and printed editions. This, however, is not the case, even if some names, mentioned by Marco Polo, or some specially attractive inscriptions from the 'Travels' had crept into some


96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 11
LA DESCRITTIONE DELLA PRIMA PARTE DELL' ASIA
Con i nomi antichi & moderni.
Di Jacopo Gaſtaldi Piemonteſe cosmografo.
Comincia queſta uerſo Oriente al regno di Tarse alla prouincia di Charaſsam, di Sableſtam,
al regno di Cabul' et alla prouincia di Guzarate: da Occidente ha il suo principio al ſtretto
di Conſtantinopoli: uerſo Settentrione alla prouincia di Seuora, & Sibiera: da Mezzo giorno al
mar Roſso, et al golfo di Perſia, con la prouincia di Circam nella quale si comprendono, la
maggior parta de paesi, che poſsiedono il prencipe dé Turchi & il Re Sophi · i confini dé
quali qui ſi distinguono con piccioli punti et in tal modo parimente si diuiduno i circonuicini paesi
dá regni ſopradetti. graduate in longitudine, & latitudine citta, caſtella, monti, fiumi, golfi, porti,
capi, et isole miſurata ogni diſtantia con miglia Italiane. Reſtituita da Antonio Lafreri.
L'ANNO · ∞ · D · LXI ·
50 100 150 200 250 300 350 400 450 500
Scala de miglia Italiani
Jacobus Boſsius belga, sculpsit
Iccimby f.
Cauabusi
Caracus
Paganſa
ZAGATAI
TARTARI
Chesel f.
Cant
Chesolitiz
TVRCHESTAN
REGI
Ocerra
RENACHER
Siminan
PRO
Saluna
Giend
Teras
Sechon
SIR
Eillach

TITLE VIGNETTE OF PRIMA PARTE DELL' ASIA. SIZE 0·9 OF ORIGINAL.

of the maps of the fourteenth, fifteenth, and sixteenth centuries; *e.g.* in Atlas Catalane, in Fra Mauro's planisphere, in some of 'Tabulæ Novæ,' in the Italian edition of Ptolemy, which was published in Venetia in 1548. At all events, neither Ramusio, Zurla, Baldelli, Bürck, Yule, nor, as far as I know, any other of the many learned men who have devoted their attention to the discoveries of Marco Polo, have been able to refer to any maps in which all or almost all those places mentioned by Marco Polo are given.

All friends of the history of geography will therefore be glad to hear that such an atlas from the middle of the sixteenth century really does exist, viz. Gastaldi's 'Prima, seconda e terza parte dell' Asia.'

These maps have certainly been cited now and again, *e.g.* in Carlo Castellani's 'Catalogo delle opere Geographiche del Collegio Romano' (Roma, 1876), in 'Catalogue of the Maps in the British Museum,' 1885, in 'Facsimile Atlas and Periplus,' and in the last-mentioned work they are carefully reproduced in phototype, but hitherto their significance as regards the Marco Polo investigations has been completely ignored.

From the original at present in my collection I here reproduce in zincotype the complete title-vignettes of the maps.* They are beautiful copper-plates, rich in names. The size of the originals is: Tabula prima dell' Asia, 0·733 × 0·430; Tabula seconda dell' Asia, 0·746 × 0·475; and Tabula terza dell' Asia, 0·733 × 0·635. This last-mentioned leaf consists of two connected parts, the upper being 0·733 × 0·479, the lower 0·733 × 0·156, all in metres. These maps are all reproduced in 'Periplus,' Plates LIV., LV., and LVI., almost in full size.

There are two specially printed leaves which belong to the two maps first mentioned, viz.—

(1) "I nomi antichi et moderni della prima parte della Asia . . . de Giacobo de Gastaldi † Piamontese Cosmografo." Beneath: "In Venetia 1564. Con gratia et privilegio dell' Illustriss. Senato di Venetia per Anni 15." One leaf in folio. Size in metres of the text, 0·390 × 0·293.

(2) "I nomi antichi et moderni della seconda parte dell' Asia Di Giacomo di Castaldi Piamontese Cosmographo in Venetia 1564." Beneath: "Con gratia et privilegio del Summo Pontifice Papa Pio quarto per Anni X. Et dal Serenissimo Senato di Venetia per Anni XV." One leaf in folio. Size in metres of the text, 0·409 × 0·282.

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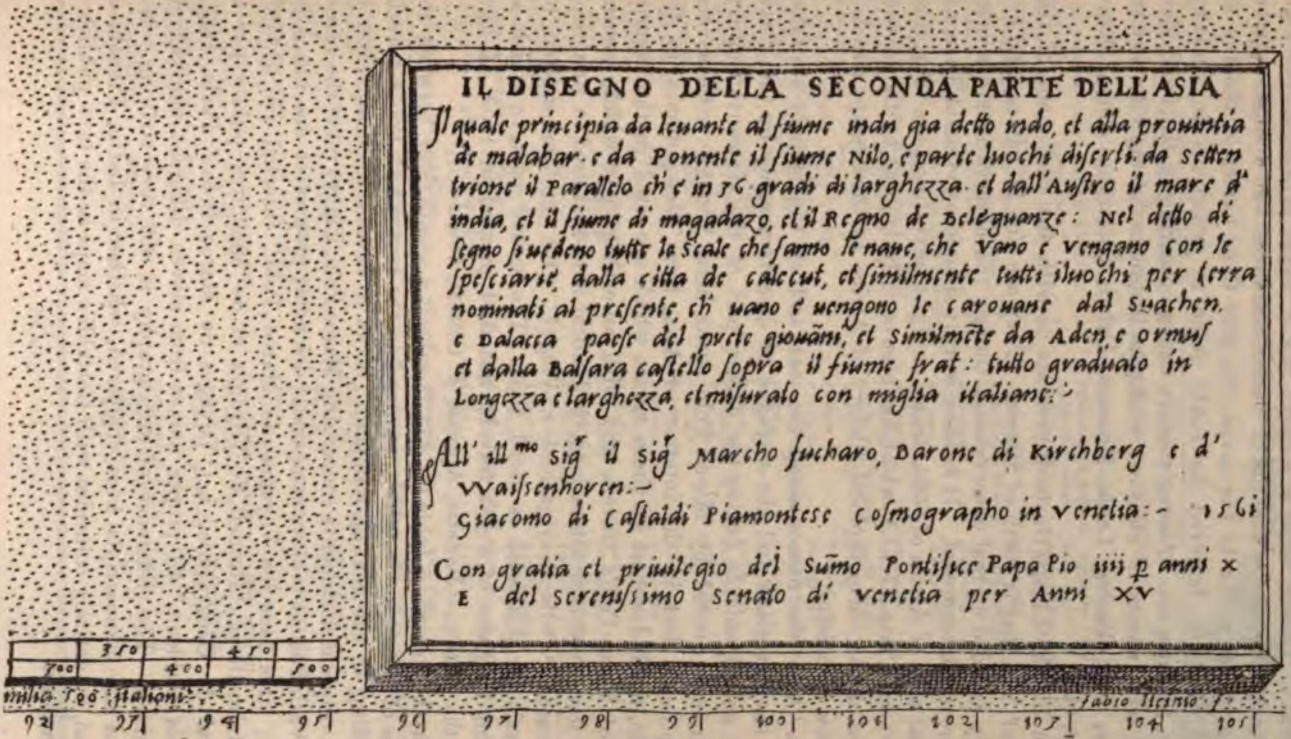
* As is usually the case with Italian maps engraved in copper of the sixteenth century, it is probable that these maps were almost simultaneously engraved on copper several times. At any rate, in 'Manno and Promis Notizie di Jacopo Gastaldi' ("Atti della R. Accademia delle Scienze di Torino," vol. xvi. 1881), an edition of 'Il disegno della prima parte dell' Asia 1559, Fabio Licinio f.' is cited. This edition, or impression, which in all probability differs but slightly from the print of 1561, I have not seen.

† As will be observed, Gastaldi's Christian and surname are both written differently in these copies. The learned cosmographer can therefore scarcely have himself superintended the reproduction of his work by the printing-press, or else, like so many learned and other men from the fifteenth and sixteenth centuries, felt indifferent as regards the orthography of his own name.



IL DISEGNO DELLA SECONDA PARTE DELL'ASIA

Il quale principia da leuante al fiume indu gia detto indo, et alla prouintia de malabar. e da Ponente il fiume Nilo, e parte luochi diſerti. da settentrione il Parallelo ch' e in 36 gradi di larghezza. et dall'Auſtro il mare d' india, et il fiume di magadazo, et il Regno de Beleguanze: Nel detto diſegno ſi uedeno tutte le ſcale che fanno le naue, che vano e vengano con le ſpeſciarie, dalla citta de calecut, et ſimilmente tutti i luochi per terra nominati al preſente, ch' uano e uengono le carouane dal Suachen. e Dalacca paeſe del prete gioāni, et ſimilmēte da Aden, e ormuſ et dalla Balſara caſtello ſopra il fiume frat: tutto graduato in Longezza e larghezza, et miſurato con miglia italiane:–

All' ill^{mo} sig^{r} il sig^{r} Marcho fucharo, Barone di Kirchberg e d' Waiſſenhoven:–
Giacomo di Caſtaldi Piamonteſe coſmographo in venetia:– 1561

Con gratia et priuilegio del Sūmo Pontifice Papa Pio iiij p̱ anni x
E del sereniſſimo senato di venetia per Anni XV

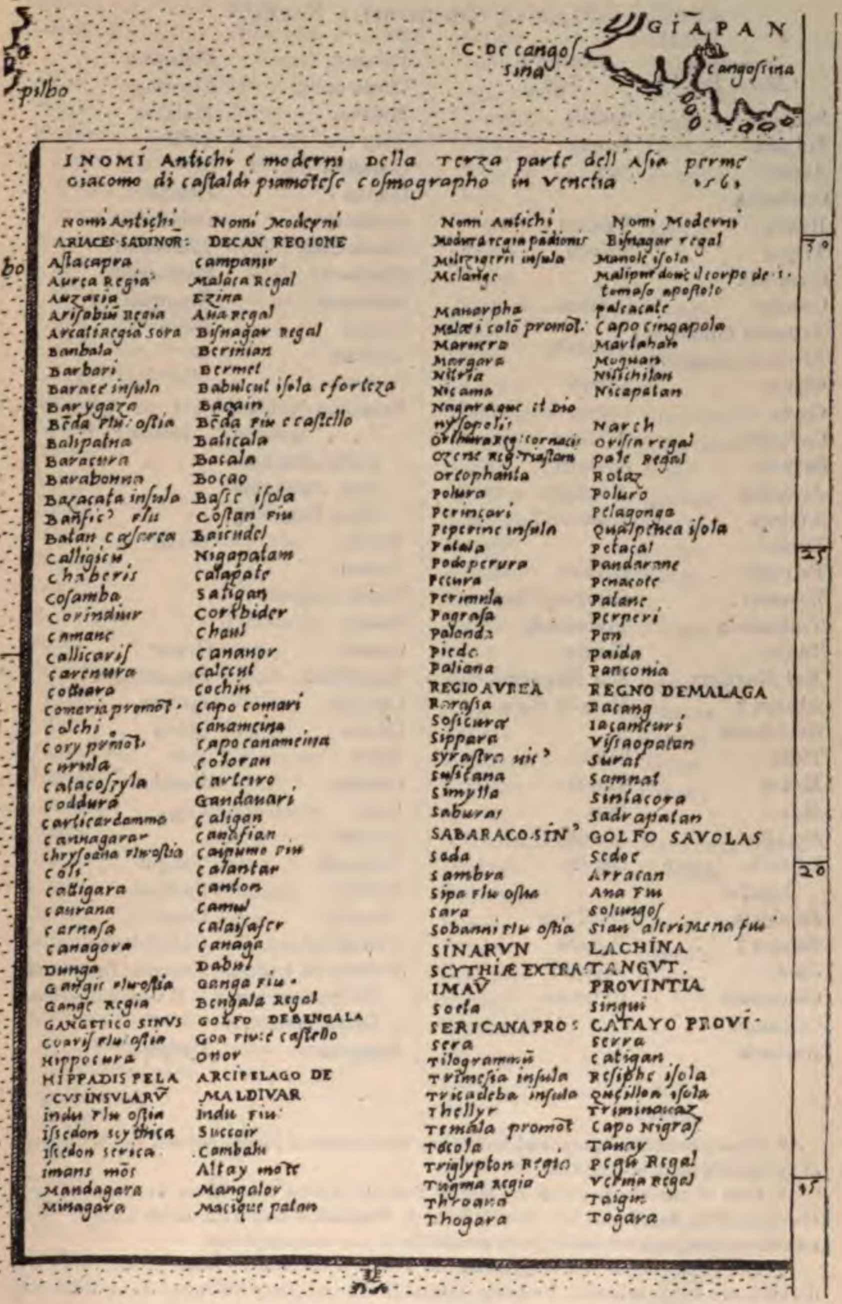
TITLE VIGNETTE OF SECUNDA PARTE DELL' ASIA. SIZE 0·9 OF ORIGINAL.

To the third map there is no special leaf with "nomi antichi e moderni." Instead there is a short list of names printed on the right margin of the map. The list of names embraces but a small number of the names given in the maps, viz. only those names of the day for which Gastaldi believed he could refer to synonyms in Ptolemy, Pliny, Solinus, etc. Among modern names occurring in them and identified with names in classical works, as instances let me cite Scutari Volga, Don, Bachu, Lassa, Buccara, Cabul, Guzarate, Aden, Decan Altay, etc.

In his three maps Gastaldi presents us with the first maps of that part of Asia that is south of Siberia. They are rich in names, and evidently founded on real observations, though the observations are often incorrectly interpreted. It forms a worthy sidepiece to Gastaldi's monumental map of Africa of 1564, drawn on eight leaves(compare 'Periplus, p. 130 and Plate XLVI.), which has been equally ignored by the investigators of the cartographical history of Africa as those maps which I am now discussing.

In 'Asia' the names along the coast and on the islands are taken from the Portulans and the voyages of discovery made by the Portuguese and Spaniards during the earlier part of the sixteenth century. The names quoted by Marco Polo occur here, though with several exceptions. But in the interior of Asia, from Mesopotamia to the Pacific, we find almost all those names which are used in the description of Marco Polo's travels, and with an orthography which, barring some few systematic alterations, is identical with that used in Ramusio's celebrated 'Delle Navigationi e Viaggi.' One preface written by Ramusio for this work is dated 1553. The second part, in which an account is given of Polo's travels, was first printed in 1559. I have used the edition, 'Venetia, Apresso T. Giunti, 1583.'

In the following table (p. 402) I submit a comparison between the names of places in Gastaldi's map and in the account of Polo's travels, according to the text of Ramusio. So as to extend the comparison to other original documents concerning Marco Polo, I must refer the reader to "Variantes et tableau comparatif des noms propres et des noms des lieux; cités dans les Voyages de Marco Polo," inserted pp. 533–552 in Malte-Brun, 'Recueil de Voyages et de Mémoires publié par la Société de Géographie,' i. ('Voyages de Marco Polo:' Paris, 1827). In this "tableau," all proper names from eleven different manuscripts are given. The difference of orthography is not very striking. Not one of the manuscripts here compared, whether in Latin, French, or Italian, so entirely coincides with Gastaldi's maps as the text published by Ramusio.



I NOMI Antichi e moderni della terza parte dell'Aſia per me giacomo di caſtaldi piamōteſe coſmographo in venetia 1561

Nomi Antichi	Nomi Moderni
ARIACES·SADINOR:	DECAN REGIONE
Aſtacapra	campanir
Aurea Regia	Malaca Regal
Anzacia	Ezina
Ariſobiū Regia	Aua regal
Arcati regia ſora	Biſnagar regal
Banbala	Berinian
Barbari	Bermel
Barace inſula	Babulcul iſola e forteza
Barygaza	Bacain
Bēda flu: oſtia	Bēda fiu e caſtello
Balipatna	Baticala
Baracura	Bacala
Barabonna	Bocao
Bazacata inſula	Baſic iſola
Banfic? flu	Coſtan fiu
Balan caſerca	Bairudel
calligicu	Nigapatam
chaberis	calapate
coſamba	Satigan
corindiur	cortbider
camane	chaul
callicaris	cananor
carenura	calecut
cottiara	cochin
comaria promōt.	capo comari
colchi	canameina
cory promōt.	capo canameina
curula	coloran
catacoſtyla	carteiro
coddura	Gandauari
carticardammo	caligan
cannagara	caniſian
chryſoana flu: oſtia	cainumo fiu
coli	calantar
catigara	canton
caurana	camul
carnaſa	calaiſafer
canagora	canaga
Dunga	Dabul
Gangis flu: oſtia	Ganga fiu.
Gange Regia	Bengala Regal
GANGETICO SINVS	GOLFO DEBENGALA
Guariſ flu: oſtia	Goa fiu: e caſtello
Hippocura	onor
HIPPADIS PELA	ARCIPELAGO DE
·GVS INSVLARV̄	MALDIVAR
indu flu oſtia	indu fiu
iſſedon ſcythica	Succoir
iſſedon ſerica	cambalu
imaus mōs	Altay mōte
Mandagara	Mangalor
Minagara	Macique palan

Nomi Antichi	Nomi Moderni
Moduraregia pādionis	Biſnagar regal
Melizigerii inſula	Manole iſola
Melange	Malipur doue il corpo de ſ. tomaſo apoſtolo
Manarpha	palcacate
Malæi colō promōt.	capo cingapola
Maruera	Marlaban
Margara	Mugnan
Nitria	Niſichilan
Nicama	Nicapatan
Nagaraque il dio nyſopolis	Narch
Orthura Reg: cornacis	oriſſa regal
ozene Reg: Tiaſtani	pale Regal
oreophanta	Rotaz
Polura	Poluro
Perincari	Pelagonga
Peperine inſula	Qualpetica iſola
Patala	Petacal
Podoperura	Pandarane
Pecura	Penacote
Perimula	Palane
Pagraſa	Perperi
Palanda	Pan
Piede	paida
Paliana	Pancomia
REGIO AVREA	REGNO DEMALAGA
Raraſia	Bacang
Soſicura	Iacamcuri
Sippara	Viſiaopatan
syraſtra uic?	Suraf
Suſicana	Somnat
Simylla	Sintacora
Saburas	Sadrapatan
SABARACO·SIN'	GOLFO SAVOLAS
Sada	Sedoe
Sambra	Arracan
Sipa flu oſtia	Ana fiu
Sara	Solumgoſ
Sobanni flu oſtia	Sian altrimente fiu
SINARVN	LACHINA
SCYTHIÆ EXTRA	TANGVT.
IMAV̄	PROVINTIA
Soeta	Singui
SERICANA PRO:	CATAYO PROVI·
Sera	Serra
Tilogrammū	Catigan
Trimeſia inſula	Reſiphe iſola
Tricadeba inſula	Queſillon iſola
Thellyr	Triminacaz
Temala promōt	Capo Nigraſ
Tacola	Tanay
Triglypton Regio	Pegu Regal
Tugma Regia	Verma Regal
Throana	Taigin
Thogara	Togara

COMPARATIVE LIST OF NAMES IN TERZA PARTE DELL' ASIA. SIZE 0·9 OF ORIGINAL.

TABLE OF GEOGRAPHICAL NAMES.

Ramusio's 'Marco Polo.'	*Gastaldi's 'Asia.'*
Soldadia *	Soldaia
Bolgara	Bulgar
Assara	Sara
Ouchacha	
Bocara	Buccara
Tripoli	Tripoli
Clemenfu	
Corazan	Corasan
Armenia minore	Armenia
Armenia maggiore	
Giazza	Laiazo
Cogno	Cogna
Cayssaria	Caraisar
Sevasta	Seuastro
Arcingan	Arzingan
Argiron	Erzerum ?
Darzizi	
Paipurth	Baiburt
Zorzania	Giorgiani Regi
Trabisonda	Trebesonda
Tauris	Tauris
Mar Maggiore	Mar Maggiore
Abaccu †	Mare de Bacu
Geluchalat	
Tiflis	Tiflis
Moxul	Mosul
Mus	Mus
Meridin	Merdin
Baldach overo Bagadet	Bagdet
Babilonia	Babilonia
Balsara ‡	Balsara
Jasdi	Jessed ?
Chiermain	Chirman
Camandu	
Reubarle	
Balaxan	Badagsan
Chesmur	Chesmur
Malabar	Malabar
Dely	Delli
Consalmi	
Ormus	Ormus
Cobinam	Cobinan
Timochaim	Timochan
Damasco	Damascho
Sapurgan	Sapurgan
Balach	Balch
Thaican	
Scassem	
Balaxiam (quiui si . . . trouano quelle pietre pretiose, che si chiamano Balassi) §	(qui se trouano i balassi)
Bascia	Basiar
Vochan	
Pamer pianura	
Beloro	
Cascar	Cascar
Samarchan	Samarchand
Carchan	Iarchen
Cotam	Cotan
Peym	Poin
Ciarcian	Ciarcian
Lop	Lop
Ouchah	
Tanguth	Tangut
Sachion	Sachion
Chamul	Camul
Chiuchitalas	Chinchitalas
Succuir (si truoua Reubarbaro perfettissimo . . .)	Succuir (qui nasce il vero riobarbaro)
Campion	Canpion

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* Some common geographical names, as also names of places beyond the boundaries of Gastaldi's map, are omitted.

† Four of the rivers given by Marco Polo as falling into Mare de Bacu (Herdil Geichon, Cur, Araz) are not discoverable in Gastaldi's map with those names. More recent sources have evidently been accessible to the cosmographer.

‡ The names of the six kingdoms into which, according to Marco Polo, Persia was divided, are here omitted. Probably Gastaldi deemed they belonged to a time long since disappeared.

§ I here cite only a few of the many descriptive legends which occur in the maps, and are borrowed from the account of Marco Polo's travels.

Ezina	Ezina
Carchoran	Caracoran (in three places)
Altay	Monti Altai
Bargu	Barcu
Erginul (in questa contrata si truoua il piu nobile e fino muscio)	Erginul (qui nasce il vero muscio)
Singui (Jui si trouano molti buoi saluatichi il quali sono della grandezza quasi de gl' Elephanti)	Singui (qui ui sono buoi grandissimi come Elefanti)
Egrigaia	Agrigaia
Calacia	Calatia
Tenduc	Tendich
Cianganor	Sianganor
Xandu	Xandu
Cambalu	Canbalu
Ungut	
Taigu	Taidu
Pulisangan	Puluisangu
Gouza	Gouza
Tainfu	Tainfu
Pianfu	Painfu
Taigin	Taigin
Caramoran	Coromoran
Cacianfu	Cacinfu
Quensanfu	Quensanfu
Cataio	Cataio
Mangi	Mangi
Sindinfu	Sindinfu
Thebeth	Tebet
Caindu	Caindu
Caraian	Caraia
Jaci	Jacy
Carazan (Nascono in questi paesi grandissimi serpenti, etc.).	Carazan (. . . qui ui sono serpe' grandisime . . .)
Vociam	Vociam
Mien	Mein
Bangala	Bengala
Cangigu	Cangigu
Amu	
Tholoman	Toloma
Cintigui	Cintinguy
Sidinfu	Sindinfu
Gingui	Gingui
Pazanfu	Pazanfu
Cianglu	Cianglu
Ciangli	Ciangli
Tudinfu	Tudinfu
Singuimatu	Singuimatu
Coiganzu	Coiganzu
Quanzu	Guanzu
Paughin	Paughin
Caim	
Tingui	Tingui
Cingui	
Jangui	
Nanghin	Nangui
Saianfu	Saianfu
Quian	Quian
Cayngui	
Cianghianfu	Cinghianfu
Tinguigui	Tinguigui
Vguiu	Vguy
Quinsay	Quinsay
Tapinzu	Tapinzu
Gengui	Zengiu
Zengian	Zangia
Concha	
Fugiu	Fungui
Gieza	
Quelinfu	Quelinfu
Unguem	Unguen
Cangiu	Cangiu
Zaithum	Zaiton
Zipangu	Giapan
Zorza	
Mare detto Cin	Mare della China
Cheinan	Cheinam
Ziamba	
Giaua	Giava
Sandur	Sondaru
Condur	Condur
Lochac	
Pentan	
Malaiur	
Felech	Felech
Basma	Basma
Samara	Simara
Dragoian	Dragoian
Lambri	Lambri
Fanfur	Farsur
Nocueran	Nocueran
Angaman	Angaman
Zeilan	Zeilan
Malabar	Malabar
Murphili ouero Monsul	

Lac ouero Loac e Lar *		Chesmacoran	Chichmecran
		Soccotera	Zocotora
Cael	Calle	Abascia	
Coulam	Coulan	Adem	Adem
Cumari	Comari	Escier	
Guzerat	Guzzarate	Dulfar	Dolfar
Canam		Calaiati	Calayate
Cambaia	Cambaia		
Seruenath (Semenath)	Samnat		

The above list of names includes almost all the names of places in Ramusio's 'Marco Polo' of those regions embraced by Gastaldi's maps, as also the corresponding denominations of Gastaldi's atlas, as far as I could find them out. As is obvious, the agreement is so complete, with but few exceptions, that there can be no doubt that the atlas, as regards Central Asia and China, is either directly founded on Ramusio's edition of 'Marco Polo,' which was printed but a few years previous to that with which the maps, or rather the copper-plates thereof are dated, or else that both works are founded on a common older original document. The latter theory seems more probable to me. In its favour there are the many names not to be found in Ramusio. Ramusio gives also (ii., folio 18*a*) from a manuscript of Albufeda (Signor Abilfada Ismaël), the geographical longitude and latitude of thirty-one places, of which many occur on the maps in question, but in very different spots from that demanded by Albufeda's determinations of their positions. Gastaldi has chiefly consulted other, probably later, sources for his fine drawing, so rich in names, of Arabia and the Indian peninsula, as also for the sketch of the archipelago of Eastern Asia, and this is a proof of how difficult it then was for a cosmographer to bring about any agreement between Ptolemy's maps of South-Eastern Asia, the accounts of Marco Polo, and the "modern" discoveries, a difficulty which even now is scarcely entirely overcome.

When studying these maps, it must not be overlooked that only a small portion of the names of places are to be found in Marco Polo, and that those parts of Asia which are not touched on in the account of his travels, are as rich in names as the rest of the maps. All names, however, keep precisely the same style of orthography. For the most part they retain the decided local stamp of the various countries. Many occur for the first time in cartography, and not a few are easily identified as names existing on the maps of the present day.

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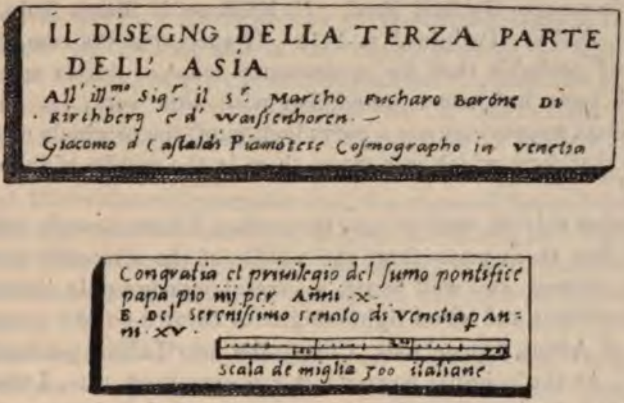
* The names Loac, Murfili, Pentam I have been unable to discover in Gastaldi's maps, but they occur, as also some few others from Marco Polo, in 'Tabula moderna Indiæ Orientalis' and 'Tabula Superioris Indiæ et Tartariæ Majoris;' in Ptolemy, 'Argentorati' (1522) (Facsimile Atlas, Figs. 62 and 63, pp. 99 and 101). In some other older maps these names, or variations thereof, are also to be found, more especially Murfili. The reason why this place has attracted more attention than others is doubtless owing to the tale of Murfili being so rich in diamonds, and the manner of collecting these stones from inaccessible abysses by throwing down pieces of meat to which the diamonds become attached, and which were fetched up by large birds of prey. In all probability Gastaldi has ascertained that the account was pure fiction, and therefore omitted to put down the formerly popular name on his map.

A remarkable circumstance is that Lake Aral is neither mentioned by Marco Polo nor entered on Gastaldi's map, if this great lake be not meant by a very small lake, Saluna lago, placed east of the Caspian, and by the river Chesel (present Kizil ?) connected with that sea.

Farther to the south there is a large river system mapped out, formed by Abia, Amu, and several other branches of a river, which, after having become united, is called Abiamu, and discharges itself into the Caspian. This is probably the first time that the river Amu (Daria) has been entered in a map under any recognizable denomination.


IL DISEGNG DELLA TERZA PARTE
DELL' ASIA
All' ill^{mo} sig^{r} il s^{r} Marcho Fucharo Barone Di
Kirchberg e d' Waſſenhoren —
Giacomo d Caſtaldi Piamótese Coſmographo in Venetia

Congratia et priuilegio del ſumo pontifice
papa pio iiij per Anni x
E del sereniſſimo senato di Venetia p an=
ni xv
scala de miglia 300 italiane

TITLE VIGNETTES OF TERZA PARTE DELL' ASIA. SIZE 0·9 OF ORIGINALS.

It seems, therefore, that Gastaldi had access to other accounts of travels in Upper Asia, China, India, etc., than those of Marco Polo. There is little improbability in this when we remember that simply a fortunate incident—imprisonment by the Genoese and the company of a talented man and clever scribe as his fellow-prisoner—has preserved for us the adventures of Marco Polo. It is possible that, besides those accounts of travels* mentioned in geographical literature, other information anent the superfluity of Oriental goods of every kind, the dangers threatening Europe from that quarter, and the prospect of extending in those Eastern lands the sphere of Christianity, had accumulated in the archives of Venice and Rome, and been placed at the disposal of the designers of the maps. As a good friend of Ramusio, the secretary of the Decemvirate, and as a helper of the illustrious Franco-Roman engraver Lafreri, the cosmographer Gastaldi was just the right man to whom such confidence might be shown. The dedication of 'Seconda' and 'Terza parte dell' Asia' to Marcus Fugger (Marco Fuchero), moreover, makes it probable that Gastaldi has also had access to the valuable archives of this family. Finally, it must be remembered that Gastaldi, under the guidance of Ramusio, is supposed to have aided in repairing or repainting the famous wall-maps in Sala dello scudo in Venice (compare Baldelli Boni, 'Il Millione di Marco Polo,' p. cvi. (Firenze, 1827); 'Periplus,' p. 141). If such was the case, it may be considered probable that the monumental maps of Africa and Asia by Gastaldi have had some connection with this work, *i.e.* that these copper-plate engravings are a reproduction of the originals of the wall-maps in that form which was given them in the middle of the sixteenth century.

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* Among modern works, in which mediæval accounts of travels in Upper Asia and China have been compared, and in which good references have been given to the extensive literature pertaining to this subject, let me mention the following: Henry Yule, 'Cathay and the Way thither: being a Collection of Mediæval Notices of China,' 2 vols. (Hakluyt Society: London, 1866); Yule, 'The Book of Sir Marco Polo' (London, 1875); Henri Cordier, 'Les Voyages en Asie au XIV. siècle du Bienheureux Frère Odoric de Pordenone' (Paris, 1891), etc.

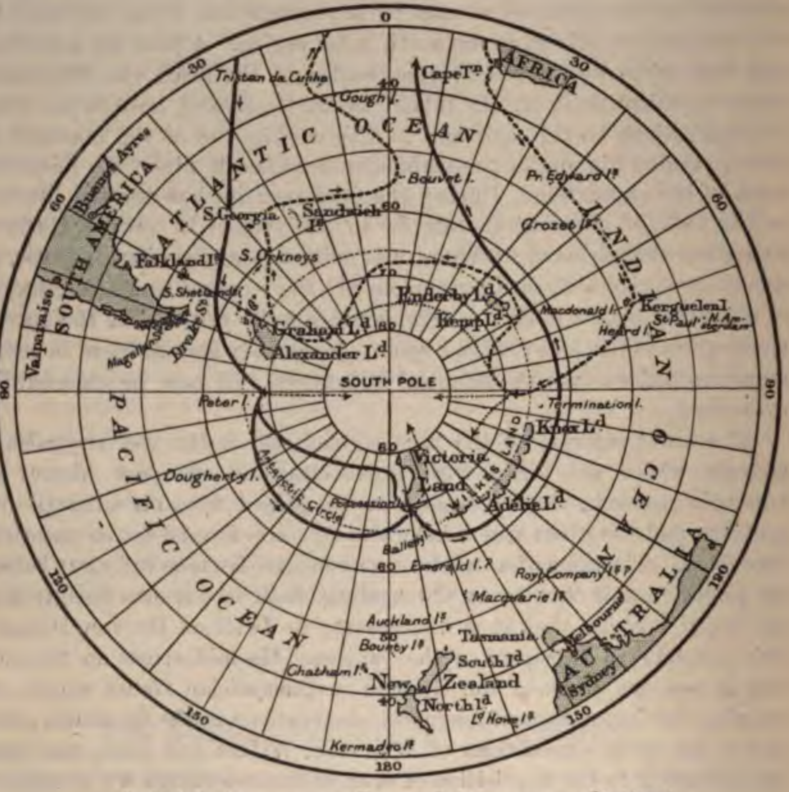
Whether this be true or not, from what I have already adduced, it is plain that these maps from the middle of the sixteenth century are of great interest and well worth a careful monographic investigation. Many important and novel lights might be thrown on the geographical history of Africa, Upper Asia, China, the two Indian peninsulas, and Arabia. As the original engravings are extremely rare, I must again remind the reader that they are reproduced in phototype (Africa, Plate XLVI.; Asia, Plate LIV.-LVI.) in my work published simultaneously in Swedish and in English, entitled 'Periplus: an Essay on the Early History of Charts and Sailing Directions' (Stockholm, 1897).

THE GERMAN ANTARCTIC EXPEDITION.

A LARGE and enthusiastic meeting was held in Berlin on January 16, in support of the projected German Antarctic Expedition, under the joint auspices of the Berlin Geographical Society and the Berlin-Charlottenburg branch of the German Colonial Society. In addition to the members of these two societies, the audience included a number of distinguished visitors, present by special invitation, while a message was received from the German Emperor, expressing regret at his inability to be present in person, and his sympathy with the objects of the meeting. These were, principally, the exposition of the aims and plan of the proposed expedition before the more influential circles of the capital, with a view to securing the needed Government support for the undertaking. The results are said to have been most encouraging, and the interest aroused in all quarters is such that it is confidently expected that all remaining difficulties will be overcome, and that the expedition will sail during the course of next year.

Baron von Richthofen, who presided as representing the older of the two societies, opened the proceedings by describing briefly the history of the project, which, as our readers are aware, has been under discussion since the Bremen meeting of the German Geographentag in 1895, when Dr. Neumayer's untiring advocacy of antarctic research attained its first practical success by the recognition of the advisability of a national expedition to the south polar region. A year ago a further step was taken by the selection, as leader, of Dr. Erich von Drygalski, whose excellent work on the inland ice of Greenland, both in the form of observations on the spot and in the working up of the material at home, pointed him out as pre-eminently qualified to direct the scientific work of the expedition. During the past year he has devoted himself to the task of arousing an interest in the project in various German cities, but though he everywhere met with an encouraging response, it was evident that without Government aid the required funds (calculated at somewhat over a million marks) could not be raised, and the recent meeting was therefore resolved upon. As already stated, there is every reason to believe that the financial difficulties will now be successfully overcome.

The chief interest of the meeting centred in Dr. von Drygalski's address, which set forth, with great clearness, the past history of antarctic research, the advantages to be gained from an antarctic expedition, and the plans which have already been formed for its practical execution. The aims of antarctic research have been so fully put before the public in this country at the meetings both at our own Society and the Royal Society, that it is unnecessary to dwell on Dr. von Drygalski's remarks on this part of the subject. He laid stress on the fact that it was the work of the German mathematician Gauss which, by showing the importance of magnetic observations in the far south, gave rise to the three expeditions of D'Urville, Wilkes, and Ross, and thus led indirectly to the acquisition of most of the knowledge we possess of that region; and also on the importance of the geographical problem awaiting solution, as shown by the fact that every new research has, unlike those in the arctic region, given more and more confirmation of the old idea that a continent does exist within the antarctic circle. As regards the programme already sketched out, the speaker pointed out the great importance of co-operation with the proposed English expedition, and his remarks should act as a stimulus to further exertion on the part of our countrymen, and lead to a determination that such an important national undertaking shall not be allowed to fall through from lack of funds. Sir Clements Markham's demonstration of the gains to be expected in the direction of practical nautical training and the maintenance of national prestige were fully endorsed by Dr. von Drygalski, and this alone should arouse the interest of those to whom the scientific results may not appeal so nearly. The route of the German expedition has been so chosen—primarily, indeed, on other grounds—as to fit in with the hints which have been thrown out in this country as to the probable sphere of action of a British expedition, the meridian of Kerguelen's land being mentioned as the most favourable line of advance towards the great unknown region. Dr. von Drygalski explained that the great quantities of drift-ice which have been met with in the Southern ocean during the past few years (since 1891) renders it likely that the ice-barrier will, at the present time, present unusually small obstacles to an advance, and as during the latter part of that period (since 1894) the Southern Indian ocean has been particularly marked by the abundance of such ice, the line recommended would seem to present greater advantages than any other. Supposing it possible to



SUGGESTED ROUTES OF GERMAN AND BRITISH ANTARCTIC EXPEDITIONS.

advance in this direction, and that a coast-line should be reached within the antarctic circle somewhat to the west of Knox Land, a winter station would be established near the margin of the ice-sheet, regular scientific operations being carried out throughout that season, while in the spring an advance over the ice in the direction of the south pole and the southern magnetic pole would be attempted. For many reasons it is considered unnecessary that the expedition should consist of more than one ship, which must be of wood on account of the magnetic observations. The voyages of the *Vega* and *Fram* have shown that success may be attained with a single ship, and though additional results might be obtained by the employment of a second, to follow an independent route, these may equally well—and it is thought with less delay—be gained through international co-operation. The ship will be constructed with a special view to sea-worthiness, rendered imperative by the stormy nature of the Southern ocean; the lines of the *Fram* cannot therefore be adopted, and the risks arising from ice-pressure (less in the south than in the north, by reason that the currents all trend *outwards*) must be guarded against by strengthening of the internal structure. It is needless to add that the German undertaking has our cordial sympathy, and it can only be hoped once more that the expected co-operation on the part of this country may not be looked for in vain.

In connection with this account, the following extract from a letter from Baron von Richthofen, President of the Berlin Geographical Society, to Sir Clements Markham, President R.G.S., is of special interest:—

"The question of antarctic exploration will, of course, take a prominent place (at the International Geographical Congress at Berlin in September). It would be a great thing if we were able to discuss the objects of co-operative action of two firmly established expeditions.

"As regards the German expedition, matters are now advancing very satisfactorily. The three most important powers—the Government, the Reichstag, and public opinion—are favourable to the scheme. We had here a successful meeting on its account. I send you a copy of the proceedings, although you may have got one by Drygalski, who is the moving spirit in the matter.

"In these proceedings you will find it repeatedly expressed as our particular desire that, in order to multiply the value of scientific work, chiefly with regard to magnetism and meteorology, the synchronous co-operation with the British expedition be firmly secured. I would, therefore, be thankful to you if you would kindly let me know how your prospects are progressing, and it would give all of us here great satisfaction if you could give favourable news.

"Although we have adopted the plan of but one vessel, an antarctic expedition cannot be carried out without a considerable expense in money and individual energy. The desire must therefore prevail to render its results as effective as possible, and it is certain that they will be greatly enhanced if a second expedition is working simultaneously on the other side of the pole.

"You would greatly oblige me by an early reply, and I hope it will be favourable."

LAKE CHOGA AND SURROUNDING COUNTRY.*

By the late Captain R. T. KIRKPATRICK, D.S.O.

THE lake is shallow for the most part; soundings varied from 2 to 3 fathoms. Patches of papyrus are scattered about, and in the shallower parts lotus and weeds of many kinds are abundant. Five or six miles east of Kaweri island the lake runs into marshy country with channels and stretches of open water; it is hard to say where it ends exactly. Except where hills are actually shown, the shores of the lake are flat, and there is usually a fringe of papyrus 10 to 50 yards wide.

The north shore is thickly wooded, as are also Gabula, Milondo, and Kagwara. The trees are mainly euphorbia, and two or three varieties of acacia. Drawing a line north and south through Kaweri island, the country east of this line is much more open, and all, both wooded and open, seems rich. There are many villages and paths, and the country south of the lake is thickly populated.

Heights of hills above the level of the lake :—

Pegi hill	800 feet.	
Hill on Kaweri island	350 „	
Hill west of Naiko hill	600 „	
Naiko hill	1000 „	(estimated).
Ungera hill	1500 „	„

The Wakedi live round the northern, eastern, and south-eastern shores of the lake. Kakunguru, the Kaganda chief who accompanied us, said those on the northern shore were hostile, and we could not land without a fight; we did not land or see anything of them. We found those on the southern shore perfectly friendly, and exchanged presents with Kenaga, chief of Msara, the chief of Sabot, and Tende, chief of Kahera. They have no tribal chief, and these men are only chiefs of villages. The men are of good height, 5 feet 7 inches to 5 feet 10 inches, slightly built, and wiry. They wear as ornaments shells, beads, brass wire round the neck, and bracelets of brass wire and ivory. Most of them wear skins or a little bark cloth round the waist, but some are quite naked. They carry spears. The women wear a string of beads round the waist, and a little skin hanging down in front, besides the usual ornaments. As a race, they have not the thick lips or flat noses which mark the negroid type, and are, in fact, less like the typical negro than are the Waganda. They keep cattle, and grow wimbi, metammeh, semsem, sweet potatoes, and bananas. Food is plentiful and cheap; two fowls could be bought for a brass cartridge-case. Their huts are circular, made of wattle and daub, and have grass roofs built in stages like the roof of a Burmese pagoda. They store their grain in circular constructions, like a large bowl, of wattle and daub, raised on piles and thatched. Their cattle are kept in enclosures of growing cactus. They make dug-out canoes with knives.

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* This report from the late Captain Kirkpatrick was received after the sad news of his death, when with Colonel Macdonald's expedition on the Nile to the east of Dufile. Colonel Macdonald and his staff have done a great amount of new geographical work during the trying operations in which they have been engaged. On Colonel Macdonald's return we hope to receive a full account of this work, to accompany the maps which have been sent home. Meantime, out of respect to Captain Kirkpatrick's memory, it has been considered right to publish this report along with the map to which it refers.—Ed. *G. J.* Map, p. 464.

The Wadope live on Kaweri and Namlimoka islands. They have the Wakedi language, and all the remarks already made about the Wakedi apply to them. They are, I think, Wakedi who, through living on islands, have got separated from the main body of the tribe. They are, however, somewhat more muscular than the Wakedi, probably owing to the amount of work they do in their canoes. They catch fish with baited hooks set like night-lines. Kakunguru has a fort on Kaweri island, and says he is their chief. He says there are about two hundred men on the island. Most of them wear bark cloth obtained from the Waganda.

Northern Usoga to the south of Lake Choga is very flat and closely wooded. There is a fairly thick population, and bananas, sheep, and fowls are plentiful and very cheap. In Gabula there are villages of Wakedi and Wanyoro as well as Wasoga; the three races do not intermarry. About 25 miles north of Lubwa's the country becomes more hilly, and the elephant grass, so familiar in Uganda, takes the place of trees to a great extent. The population also becomes denser.

Rounds of angles were taken from Pegi hill, the hill on Kaweri island, a rock near Msara, the hill west of Naiko hill, and a rock near Ngo. The instrument used was a large prismatic compass with a stand, of which the variation had been ascertained by Major Macdonald. Angles were also taken from time to time in the canoe. Distances on land were obtained from a pedometer, the time of the caravan being taken as a check. Distances on the lake were obtained from the time of the canoe, the rate of the canoe being got by timing it along the shore and then pacing the distance. A check was obtained from a rock fixed by angles from Bale, on the Kampala-Kakunguru's road, and Pegi hill. This rock is about 5 miles west of Ngo, and was also fixed by angles from Ngo and the hill west of Naiko hill. The latter position was half a mile west of the former. I did not correct for this. I took the map to all the places from which angles were taken except Pegi hill, and sketched in the details whilst actually looking at them. With regard to the names, I obtained them from the Wakedi through Kakunguru, who himself wrote them all down. I then made the Wakedi repeat them two or three times.

The name of the lake should be Choga, not Kioga; the Wakedi, Waganda, and Wasoga all call it Choga. The names in Usoga I obtained through a servant of mine, who came from that country. As to the parts shown in dotted lines, Kakunguru, who is a very intelligent man, informed me that the Niriagite channel goes six hours north from the neighbourhood of Msara, and joins Lake Kwania; this information came from the Wakedi, who also said the Nirangite was marshy in parts. Lake Kwania Kakunguru had himself seen. He said it was four to six hours' march from the north of Lake Choga, about 2 miles wide, and joined the Nile near Mruli to the south of the Marusi or Mahorsi hills. He drew a sketch of it and Lake Choga on the ground. I may mention that, before seeing it, I put in Siria bay from his description within three-quarters of a mile of the position finally fixed. The Gogonis channel, Mpologoma, were put in from the description of the Wasoga at Ngo. They pointed out the direction and named the number of days' march; I do not regard this as so reliable as Kakunguru's information. The road through Usoga is very narrow and winding; six or eight compass bearings had to be taken to a mile. The work was done with a small pocket-compass, checked, whenever possible, by long bearings taken with the big compass. On reaching Lubwa's, the latitude was correct; in longitude I was 2 miles too far to the east. A correction of a mile was made in the distance between Kibure and Namlimoka island, which was, I think, somewhat great, and the remaining mile was corrected between Ngo and Lubwa's. As the position of Lubwa's with reference to Kampala has not been absolutely fixed, it is doubtful whether these corrections should have been made. No astronomical instruments were available for my use, and I was unable to take observations.

SOME NEW BOOKS ON AFRICA.

By EDWARD HEAWOOD, M.A.

It is impossible even briefly to notice all of the many books on Africa called forth by the growing interest in that continent, and a selection must therefore be made of those most likely to possess permanent value as additions to our geographical knowledge.

First in point of date since the last batch of African books was noticed in our pages, comes Dr. Freeman's work * on the countries lying

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* 'Travels and Life in Ashanti and Jaman.' By R. Austin Freeman. London: Constable. 1898.

behind the Gold Coast, in which the author describes a journey to Bontuku made so far back as 1888, and the subject of a paper in our 'Supplementary Papers' (vol. iv.). But while, of course, presenting few novelties from the point of view of mere topography, it gives an unusually complete picture of the wider relations of the country and its inhabitants, all the more valuable by reason of the extreme scantiness of the literature of the Gold Coast back countries, and as supplying a record of the natives when little touched by outside influence. The author's lengthened residence in the colony enables him to speak with full knowledge, and he has made good use of his opportunities of observation.

In his account of his journey, Dr. Freeman carefully notes the various types of country passed through, and in his map distinguishes the areas occupied by each, defining, in addition to the main gradations from dense forest through orchard-like country (such is his term for the landscape often described as park-like) to treeless steppe, various special forms along the coast-strip west of the Volta. His remarks on the dense forest are interesting if somewhat speculative, and if accepted would tend to modify our ideas on the subject. Especially characteristic of these forests are the silk-cotton trees (*Bombaces*), which, unlike our deeply rooted oaks, etc., appear to stand on a wide-spreading, shallow base. After suggesting as a possible reason the scarcity of earthworms, which, if present, would help to bury the roots by their castings, he goes back for the primary cause to the characters of soil and climate observable in the forest. It is somewhat surprising to learn that this is marked, in contrast to the more open country, by an absence of surface soil, which Dr. Freeman supposes carried away by the excessive rainfall. This can hardly apply to tropical forests generally, from which the Ashanti forest also seems to differ by the thorny nature of the undergrowth. Its area appears coextensive with that of a red ferruginous sandstone formation. In the concluding chapters, the author treats of the dress and ornaments of the natives, the history of Ashanti and its relations to Great Britain, malaria, and commerce. He deplores the attempt to make the natives adopt European dress, which converts them from Africans to "niggers." He considers that the breaking up of the Ashanti power has had a bad effect on commerce by stopping the native caravan traffic with the far east and north, which alone could create a demand for European products. A great desideratum is the improvement of water-communications, especially on the Volta. With regard to malaria, he looks forward to beneficial results from the modern study of its nature and causes, but considers that at present the disease is increasing both in prevalence and malignity.

As dealing also with West Africa, Major Mockler-Ferryman's book * may be next referred to. It forms the first of a popular series, which should prove useful in bringing before the public the principal facts concerning the British empire abroad, and contains a mass of information brought together with much care on the history, peoples, etc., of the British West African possessions. The account of their exploration—so far, at least, as accomplished by British travellers—is very complete. A want of clearness is occasionally noticeable, which may give rise to misconception. Thus the Portuguese voyages on the West Coast are too closely connected with the search for Prester John's empire, while the murders of Dr. Vogel and his attendant Macguire are mentioned in connection with their journey to Yakoba, nothing being said of Vogel's subsequent visit to Wadai. The English word "guinea" is explained as derived from the Guinea coast, but nothing is said as to how the coast itself got its name. There is some confusion of ideas relating to the Berlin Conference of 1884–85, which is supposed to have made definite regulations regarding "spheres of influence," of which the idea even is only vaguely hinted at in the "General Act" of the conference. A confusion is shown between the decisions of this body and subsequent negotiations between individual powers, and it is even stated that "broad lines of demarcation were laid down, confining each European power to certain districts;" that "the coast possessions were apportioned a given amount of background, or, as it was termed, 'Hinterland,'" and so on. In the concluding chapter the author makes some judicious remarks on the problems of the future, of which he entertains sanguine views. The maps are not quite up to date, old plates having (as is too often the case in this country) been utilized.* Thus, for the Sierra Leone boundary, the results of the latest survey are not shown, and the source of the Niger is over half a degree out of its true position, while Abyssinia is still shown as an Italian protectorate.

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* The Imperial Library: 'Imperial Africa.' By Major A. F. Mockler-Ferryman. Vol. i., 'British West Africa.' London: The Imperial Press. 1898.

Of the various works treating of Egypt and neighbouring territories, few can be expected to add much to our geographical knowledge. We can only speak of that of Mr. Silva White, whose plucky attempt to reach the forbidden oasis of Jarabub last summer is well known. Mr. White has written an attractive narrative of the journey,† enlivened by a good deal of quiet humour. Although he calls himself an amateur, in search rather of impressions than results, he tells enough to show that a fair share of the hardships of travel fell to his lot during the passage of the Libyan desert, with its long waterless stages, whitened with the bones of camels and exposed to the stifling *Khamsin* winds. His power of imagination enables him to give a vivid picture of the desert, the spell of which he has felt in its fulness. Although unsuccessful in his ambition to reach the stronghold of Senussiism, he was able to throw some light on its recent developments, and his summary of our knowledge of the subject will be of much use to inquirers. Apart from the fierce fanaticism of this the most powerful sect in Islam, perhaps the most noteworthy fact is the doctrine of emigration from infidel countries, which must have important results in attracting a population to the Sahara. New routes are being opened up, and oases created along these highways of commerce, and we are told that any Mussulman may travel without scrip or purse across the whole breadth of the Sahara from Wadai to Benghazi. The headquarters of the sect is now at Kufra, Jarabub serving merely as a sort of university for its adherents.

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* The rainfall map first appeared twenty years ago!

† 'From Sphinx to Oracle.' By Arthur Silva White. London: Hurst & Blackett. 1899

The unusually friendly relations which Mr. White was able to maintain with the people of Siwa gave him special facilities for observation, and his description of the place shows what a mine of interesting material awaits further research. The town is described as "one solid though friable rock, sculptured into dwellings, past and through which streets, lanes, rough causeways, flights of steps, tunnels, and galleries lead from point to point, laterally, vertically, spirally." Although Egyptian territory—the reputed frontier lies half a day's march to the west—Siwa is as much out of the world as the most remote districts of Central Africa, and the few Egyptian officials are exiles in effect if not in fact. Mr. White's photographs give an excellent idea of the outward appearance of the place.

As dealing with a somewhat kindred subject, the English translation of Captain Bruun's work,* originally published four years ago, may here be mentioned. It gives the account of a journey made among the Berber tribes of the Matmata mountains and neighbouring regions of Southern Tunisia, respecting whom any addition to our knowledge is welcome. Unlike the Senussi sect, these Berbers are the least fanatical of Moslems, and Captain Bruun met with a cordial reception among them. He gives a useful chapter describing the various tribes of Tunisia.

The volume † in which Lieut. Werther publishes the results of the Irangi expedition of 1896–97, is one of those records of solid scientific work which so often appear in Germany. The actual description of the journey is wisely kept within very moderate limits, and the bulk of the volume is taken up with memoirs by experts on the scientific observations and collections made by the leader and his companion. Thanks to the liberal way in which the expedition was equipped, these are unusually valuable. Lieut. Werther's clear sketch of the physical geography of the countries visited had previously appeared in substance in *Petermanns Mitteilungen*, together with the map, and has already been noticed in the *Journal* (vol. xii. p. 189). Full details are given as to the methods employed for the astronomical, barometrical, and other observations, and the degree of confidence to be placed on the results. Lieut. Werther kept throughout a meteorological journal, which gives both barometrical and temperature readings with great regularity, and occasionally the vapour pressure and relative humidity. Unusually high maxima of temperature have been omitted as possibly due to effects of radiation. The relative humidity (in the rainy season) is never recorded as below 86 per cent. The geological observations—the work of Herr von Tippelskirch—are of special value. Some hundreds of specimens were brought back, consisting mainly of archæan schists and granites, sedimentary and eruptive rocks being proportionately scarce. Herr von Tippelskirch thinks, however, that the outbursts of Mount Gurue must have been very considerable and of no very remote date. The zoological collections are also reported on, and Prof. Luschan gives a useful *résumé* of our knowledge of the native tribes.

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* 'The Cave-dwellers of Southern Tunisia.' London & Calcutta: Thacker. 1898.

† 'Die mittleren Hochländer des nördlichen Deutsch-Ost-Afrika.' Von C. Waldemar Werther. Berlin: Paetel. 1898.

Another German work lately received is Dr. C. Keller's account of the East African Islands,* forming the second volume of the 'Bibliothek der Länderkunde.' It deals with Madagascar and the groups in the Southern Indian ocean, including even Kerguelen's Land, the Crozets, etc., but not Zanzibar or other islands near the coast. It is not solely a compilation, although all the best authors have been consulted, for the author has visited most of the islands, and thus writes from personal knowledge. Madagascar, of course, occupies the largest space, a clear description being given of its natural features under various aspects, as well as of the history of exploration and attempts at colonization. Dr. Keller lays stress on the long isolation which has resulted in the present peculiar forms of life, holding, unlike Keane, that the ancient Indo-African continent dates back entirely to pre-Tertiary times. With regard to the inhabitants, too much stress must not be laid on linguistic facts, for only the Hovas are really of Malay affinities. The book is well illustrated and provided with maps, and forms a useful summary of our knowledge respecting the East African Islands.

The publication of a life of Emin Pasha,† after the voluminous literature which appeared in connection with the Relief Expedition, may appear to some uncalled for; but it must be remembered that the events which came before the public at that time formed a very small part of the whole life and work of the Pasha in Africa, and that no just verdict on his achievements could be given from the fragmentary accounts previously published. Whatever opinion may be held of Emin's powers of administration, there can be no doubt that on the field of scientific work he stands in the very first rank of African explorers. With the exception of the volume published in 1888, no systematic record existed of the years of labour devoted to the task he had made his own, so that an impartial and authoritative history of his life, such as Herr Schweitzer has written, was distinctly needed. On many points it sheds new light, for the author has had access to the whole of Emin's diaries, and to correspondence not hitherto made public. Although by no means blind to Emin's faults, Herr Schweitzer occasionally shows a national bias, which arises in great part from misconception. Dr. Felkin's introduction to the English edition, and the letters of Emin there printed, fully exonerate his sympathizers in this country from the imputation of interested motives, and show how completely at one time Emin looked to Great Britain for support, even by political action. The closing acts of his life can only be explained, Dr. Felkin thinks, by the extraordinary and unexpected influence sometimes exercised by nationality.

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* 'Die Ostafrikanischen Inseln.' Von Prof. Dr. C. Keller. Berlin: Schall & Grund. 1898.

† 'Emin Pasha: his Life and Work.' By Georg Schweitzer, with Introduction by R. W. Felkin. London: Constable. 1898.

The latest contribution* to our knowledge of the countries bordering on Emin's old province to the west is supplied by Captain Guy Burrows, an English officer in the service of the Congo State, who played an important part in the pacification of the Upper Welle region in 1894–97, and has since been promoted to the post of commissioner of the Aruwimi districts. Very little has hitherto been published with regard to the many Belgian expeditions into remote corners of the State, so that any new information is to be welcomed. With Captain Burrows's narrative are interspersed voluminous notes on the natives of the Upper Welle, of whom he seems to have made a special study. The title of the book is somewhat of a misnomer, as the author touched only the northern fringe of the pygmy habitat, and his chief dealings were with the Azande tribes, with whom the State was then at war. His notes on these are perhaps the most valuable part of the book, considering the importance which has been attached to them as helpers in the regeneration of this and adjoining parts of Africa. He was struck by their total difference from the Negroes, and says that but for their colour many of them might be taken for European Jews. It is perhaps to be regretted that collision with the white man has prevented the formation of a powerful Azande empire, which their previous victorious advance seemed to render possible. A chapter is devoted to the subject of cannibalism, which the author says is certainly not due now to the pressure of hunger, nor to the idea that courage may be acquired by the practice. The book suffers from the want of a map and index, the spelling of names is far from systematic, and the illustrations have often no immediate reference to the text. Though sometimes very indistinct, they have at least the advantage of being trustworthy. Mr. Stanley's introduction is largely a defence of Belgian policy on the Congo.

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* 'The Land of the Pigmies.' London: C. A. Pearson. 1898.

The doings of the French to the north of the Congo State have likewise been the subject of few publications, so that M. Castellani's book,* describing the early stages of the Marchand Mission, to which he was attached, may be of some service at the present time, though written in a popular style and laying no claim to scientific value. Another recent publication with an indirect bearing on French colonial undertakings is M. Schirmer's translation of Von Bary's journal,† kept during his journey to Air in 1876–77, since which no European has visited that country. As the journal had already been published in German, the value of the new edition lies principally—apart from the attention called by it to a traveller whose work is not widely known—in the translator's notes and geographical index, and the appendix, in which he has brought together the meteorological data scattered throughout the journal.

A useful collection of documents relating to the partition of Africa, compiled by Captain Van Orthoy, has been lately issued in Brussels.‡ Its plan coincides in the main with that of Hertslet's 'Map of Africa by Treaty,' but its bulk has been lessened by the omission of all agreements regarding cessions of territory in the past which have fully taken effect. All documents, however, are included which are still in force as fixing international boundaries. The arrangement is chronological, but a classified table gives the reference to the documents under the head of the powers interested. A useful feature is the retention of the original language or languages of all the documents, while the collection includes some important treaties signed since the publication of Hertslet's work, such as the latest with Abyssinia. Other important documents not given in the latter are the Sultan's firmans of 1841 and 1865 relative to the Eastern Sudan, and the declaration of neutrality of the Congo State signed at Brussels in 1894, which contains a full statement of the then-existing boundaries. No information is given respecting the limits as laid down in 1885, which may still be of importance as regards the frontier north of Tanganyika. The map has been carefully compiled, and contains no error of importance.§

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* 'Vers le Nil Français.' Paris: Flammarion. [1898.]

† 'Le Dernier Rapport d'un Europeau sur Ghat et Les Touareg de l'Air.' Paris: Fischbacher. 1898.

‡ 'Conventions Internationales définissant les Limites Actuelles des Possessions, etc., in Afrique.' Brussels: Soc. Belge de Librairie. 1898.

§ The following minor inaccuracies occur: The whole western shore of Lake Albert is coloured as if leased to the Congo State, whereas the leased portion ends immediately south of Mahagi. The territory actually dominated by Abyssinia is not shown as extending far enough to the south-east, and there is no indication that the territory west of the upper Zambezi is still unapportioned between Portugal and Great Britain. The British Central Africa Protectorate is also wrongly shown as extending west to Lakes Mweru and Bangweolo.

One or two quite recent works must be added to our list. The first of these is Sir Harry Johnston's manual on the colonization of Africa.* The title hardly perhaps explains the true scope of the volume, which is not confined to colonization in the strict sense of the word, but really embraces the whole history of intercourse of foreign nations with Africa from the earliest historical periods, while the question of the possibility of European colonization in that continent is very briefly touched upon, as is but proper considering the historical standpoint adopted. Sir Harry Johnston's writings are always original and suggestive, and he has succeeded in making the present work much more than a dry record of facts. After an opening chapter on the early history of Africa down to the close of the Mohammedan invasion, he takes up separately the history of the various European nations in Africa, with chapters on the slave-trade, missions, and exploration. This method of treatment involves a certain lack of historic continuity, by which the wider aspects of the subject are somewhat obscured, but this was perhaps unavoidable. The remarks in the opening chapter on the racial history of Africa are interesting, though decidedly speculative. The author considers the Negroes, Hamites, and Semites as offshoots from one stock, the divergence probably taking place in Arabia. He endeavours to sketch the distribution of races about 3000 years ago, at which comparatively recent date he thinks the Negroes had not pushed far beyond the Equator, the Bantu dispersion from a home on the Nile-Congo watershed being held to be more recent. In telling the story of European enterprise, he shows a wide knowledge of the facts, and gives much interesting information not generally accessible, especially with regard to the earlier periods. The chapter on exploration is perhaps the best account for its length which has appeared, though containing one or two slips.† The concluding remarks on the probable future of the continent are deserving of attention. The author considers the parts suitable for colonization by Europeans to be practically limited to extra-tropical Africa, which, however, offers room for a great influx of population. He looks forward to a large overflow from India into the more sparsely peopled tracts of East Africa; to a less rigorous observance of Mohammedanism on the part of its adherents; and to a gradual identification of the Negroes with their respective European rulers.

Readers of Miss Kingsley's former volume on West Africa will have learnt to expect from her pen nothing of the commonplace, and her new work [*] on the same subject fully sustains the reputation of its predecessor in this respect. Freshness, force, and originality are its undoubted characteristics, and whatever may be the verdict respecting the views put forward, it is bound to rivet the attention of the reader from beginning to end, and provide both entertainment and instruction. The authoress has put down her ideas in the language that came first to hand, and for this very reason succeeds in driving home her points in a way that no nice choice of expression could effect. Needless to say, she has very decided opinions of her own, but they are often too much the result of personal bias and disinclination to see things in a commonplace light to be entirely convincing. Her predilections for the West African traders (with whom she is proud to identify herself), for the Negroes in their unsophisticated state, for the country itself, and in a lesser degree for French colonial methods,[†] make her, in particular, somewhat blind to the less favourable side of the picture. The book deals with a variety of topics, from the animal pests which everywhere make their presence felt, to the native laws of property and religious systems, and brings home to the reader in a forcible way the characteristics of the West African coast, not, however, untinged with a certain romantic halo. The subject most fully treated is the fetish question, which received less attention than it deserved in the former work, and on which new light may be thrown, Miss Kingsley thinks, by the recognition of at least four distinct forms or "schools" of fetish. In an interesting chapter devoted to early trade, the "silent trade" mentioned by the old writers is discussed, and accounted for—in West Africa—by the influence of fetish.[‡]

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* Cambridge Historical Series: 'The Colonization of Africa.' By Sir Harry H. Johnston, K.C.B. Cambridge University Press. 1899.

† We are told, *e.g.*, that Matteucci and Massari were the first to cross Africa from east to west; also that Révoil followed the brothers James in the exploration of Somaliland, and that Uechtritz and Passarge were explorers of the region between the Cameroons and the Benue watershed.

The section of the book with the most practical bearing at the present time is that which deals with the trade and government of British West Africa. Miss Kingsley speaks in the highest terms of the value of West African trade to the British Empire, holding that such tropical countries stand in the front rank (before India and China even) among future markets for manufactured goods. She is an uncompromising opponent of the Crown Colony system, on which she lays all the blame for the little progress yet made in the development of West Africa. She puts forward a detailed scheme for the replacement of the present system, which certainly merits careful attention, although no doubt open to certain objections. A valuable addition to the book is formed by two appendices by traders long resident in West Africa, who have been prevailed upon to impart to the world some of the stores of information so rarely made available in such cases.

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[*] 'West African Studies.' By Mary H. Kingsley. London: Macmillan. 1899.

[†] It is curious to notice that where Miss Kingsley saw so much to excite her admiration, a French traveller, M. Foa, found cause for regret in the state of stagnation observed.

[‡] Many other accounts of dumb trading might have been added to Miss Kingsley's list, *e.g.* of the older writers, those of Pliny, Cosmas Indicopleustes, the Periplus of the Erythræan sea, Ibn Batuta, and John de Marignolli. The earliest intercourse of the Russians with the Chukches is said to have been carried on in this fashion, while in modern times the Poliars of the Pulney hills are said to adopt the practice. The modern form seen by Miss Kingsley in West Africa is also mentioned by Mr. Millson (*Proc. R.G.S.*, n.s. xiii. 582).

Mr. Bindloss's recent account of the Niger delta * will be read with much interest in connection with the work last spoken of, and is particularly useful as placing before the public many of the same facts in a somewhat different light. The author was attracted to West Africa by the desire to gain for himself some accurate knowledge of that region, the truth respecting which is so difficult to arrive at. The date of the journey is not mentioned, but internal evidence shows that it was anterior to the Benin massacre. Mr. Bindloss possesses considerable descriptive powers, and presents a series of unusually vivid pictures of nature in the Niger swamps, and particularly of the life of European traders, officials, and missionaries in that fever-stricken region; supplementing his own observations by many anecdotes and narratives connected with its history. His descriptions of the calm but strong flow of the delta streams, of the rapid obliteration of man's work by the vigorous force of nature, and of the toilsome building up of solid ground as the foundation for new stations, deserve special mention. Amid many harrowing stories of disease and death, as well as of human cruelty and superstition, there are also brighter pictures of heroic fortitude and devotion to duty. To the question, "Is it all worth while?" the author gives an unhesitating "Yes," laying stress on the advantages accruing to the home population from the trade of the region, while not the least gain is the drastic training which alone can maintain the vigour of a nation.

A very brief notice must suffice for the remaining books on our list. Mr. H. C. Thomson gives † a thoughtful discussion of the South African problem, as regards the new territories of Rhodesia, from the standpoint of a champion of the native races and an enemy of monopoly and speculation. He has many severe things to say of Mr. Rhodes, but, though a vigorous critic of our policy towards the Transvaal, he allows that the abuses in its government have much to answer for. The irrigation question in German South-West Africa is very thoroughly dealt with in a work by Herr Rehbock,‡ an engineer who visited the country on behalf of a syndicate, and who also sketches briefly the physical geography of the territory, and discusses its agricultural capabilities and possibilities of development. He advises—besides such steps as the improvement of means of communication—the

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* 'In the Niger country.' By Harold Bindloss. Edinburgh and London: Blackwood. 1898.

† 'Rhodesia and its Government.' London: Smith & Elder. 1898.

‡ 'Deutsch-Südwest-Afrika.' Berlin: Dietrich Reimer. 1898.

establishment of agricultural colonies, and selects as the most suitable spot for a first experiment the neighbourhood of Hatsamas, south-east of Windhoek. The book is well provided with maps and diagrams, as well as with excellent photographic illustrations, and is a valuable addition to our knowledge of the country. German East Africa, again, is the subject of a work by Dr. F. Wohltmann,* who gives the results of his examination, as an expert, of the agricultural resources of that territory. His account is decidedly encouraging, and, with the illustrations which accompany it, gives an impression of progress and order which speaks highly for the persevering labours of German pioneers in that field. In spite of the large outlay which has been necessary to secure these results, the author considers that the benefits to the nation are such as fully to repay it. The work should be useful as a guide to those interested in similar undertakings in other parts of tropical Africa. Lastly, M. Wauters, than whom no one could have been better qualified for the task, gives a succinct account† of the Congo Free State, detailing the history of its foundation and development, and sketching the outlines of its geography, ethnology, and economic resources. The book will be of much value for purposes of reference, as it brings into convenient compass a mass of information elsewhere widely scattered.

WADDELL'S 'AMONG THE HIMALAYAS'—REVIEW.

By Colonel Sir T. H. Holdich, K.C.I.E., C.B., R.E.

AMONGST the native states of the Himalaya, the little state of Sikhim is unrivalled for the magnificence of its scenery; and it possesses, besides, considerable political interest. Major Waddell's book gives a clear and very readable account of this part of the great Himalayan system, and if he has struck out no new or very original line of his own, he has at least made a pleasant study of a subject which can never lack interest so long as the love of mountaineering is inherent in Englishmen. Sikhim comprises the upper basin of the Teesta river, the headwaters of which rise near the northern passes to Tibet and Lhasa, which latter place is much more readily accessible from Sikhim than from any other part of our frontier. It is this which gives Sikhim a certain political, if not strategical, value. On its west is the gigantic chain of mountains culminating in Kanchenjunga, a spur from the main Himalayan axis, which separates Sikhim from Nepal. On the east another long southern extension from the Central Tibetan plateau shuts off Bhotan; but dovetailed in between Bhotan and Sikhim is a triangular wedge of Tibetan territory called Chumbi, which lies south of the Indo-Tibetan watershed, and which, until the end of last century, actually belonged to Sikhim. Through this extension flows the Mo river and its tributaries to the plains of India, and the route afforded by this river (which lies partly in Tibet territory and partly in Bhotan) is the only route which, according to Major Waddell, would open up direct communication between Tibet and the plains of India without encountering any formidable passes whatever. But there appears to be something wanting in Major Waddell's information as to the nature of the Mo route south of Rinchingong. The river is known to flow through an impracticable gorge where it washes the foot of Gipmochi, and this would certainly offer a considerable obstacle to any road project, to say nothing of a railway. Accurate surveys of Western Bhotan do not at present exist, although much valuable reconnaissance was completed by Godwin Austen during the Bhotan campaign of 1865–66.

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* 'Deutsch-Ost-Afrika.' Schöneberg-Berlin: Telge. 1899.

† 'L'État Independant du Congo.' Brussels: Falk. 1899.

Major Waddell's first excursion was from Darjiling by the Tibetan trade route to Gantok, and thence to the quaint native capital of Sikhim (the residence of the "king") Tumlong. This excursion took place about ten years ago. Meanwhile this route has developed rapidly under the able management of the local political officials. It will not be long before a cart road is open from Silligori (the terminus of the Northern Bengal railway) to Gantok, and with the increased facilities for communication thus afforded, a great impetus should be given to Tibetan trade. With this road in existence, the advantage of opening up any route which lies outside Sikhim territory becomes more than doubtful.

From Tumlong (of which mountain capital Major Waddall gives a most interesting account) his route lay northward by the Lachun valley to the glacial region which encloses the Donkia pass. He had a look at one or two little-known passes south of the Donkia, leading into the Chumbi basin, and then returned southward to follow the line taken by our troops under General Graham, when they turned the Tibetans out of Sikhim into Chumbi, over the Jelep pass, in 1887. It should be noted that the best-known and most frequented routes to Lhasa appear to be concentrated on the passes at the head of the Chumbi, or Mochu, valley, after passing from the Teesta basin by the Jelep (14,380 feet). This pass thus becomes an important point on the line of frontier communications. This route from Phari onwards was followed by Turner in 1783, and is obviously a route which is open to the passage of considerable bodies of men, or the Tibetans could hardly have used it. It avoids the gorge of the Mo river below Chumbi.

Interesting as Major Waddell's record of this north-eastern exploration may be, it is amongst the glaciers and snows of the north-west, lying under the cold shadow of Kanchenjunga and its kindred peaks, that the attraction of his story chiefly lies. Kanchenjunga, although not even the second highest peak of the Himalayan system, is not 1000 feet lower than Everest; and its dominant position, facing the forest-clad slopes of the outer ranges at Darjiling, invests it with a picturesque grandeur that is probably unequalled by any other mountain in the world. Everest (29,000 feet) is higher; but it unfortunately lies on the border between Nepal and Tibet, in a position so remote and inaccessible as to be beyond the reach of European exploration, and it is only doubtfully visible from the neighbourhood of Darjiling. Another gigantic peak, called Khambalung (which figures as Peak xiii. in survey records), lies in such close proximity as to interfere with any comprehensive view of the actual slopes of Everest from the south-east. It is only on the great western watershed of Sikhim dividing the Teesta affluents from those of the Tambar, in Nepal, that a really clear view of Everest over-topping the shoulder of Peak xiii. may be obtained.

Is there any peak higher than Everest lying beyond it to the north or north-west on the borders of Tibet? This is a question which Major Waddell is unable to answer positively, but the general testimony of such explorers as have sighted Everest from the Tibetan side, coincides with that of the surveyors who have fixed the position of the great peaks of the Himalaya from the Indian frontier—that there is not. The Tibetan name for the Everest group appears to be Lap-chi-kang, or "the outer glacier pass," and that of the actual peak, Jomo-kang-kar, or "the Lady White glacier;" and these Tibetan people, who "inhabit the surrounding country, and ascend the sacred mountain for purposes of worship, as far as they dare," speak of another Lap-chi-kang beyond it to the north, which they believe to be higher. The only European authority for a higher altitude than Everest is Mr. Graham, who claimed to have ascended Kabru (24,000 feet), a peak to the south of Kanchenjunga, and on the same great spur of the central Himalayan axis. But Mr. Graham was almost certainly mistaken in the peak which he ascended (Major Waddell investigates this question at some length), and his observations are hardly trustworthy; whilst it is obviously impossible that Tibetans living at the foot of these mountains can have the means of discriminating between comparatively small differences of height amongst such vast altitudes. Until triangulation can be so far extended as to cover all the high altitudes bordering Nepal on the north, the doubt must remain unsolved; but it is extremely unlikely that any higher peak could have remained undetected, even with such observations as we at present possess.

It is hardly surprising that Major Waddell should have found much difficulty in determining his absolute elevation by means of aneroids or hypsometers. The former are proverbially uncertain, and the latter require much more skill to manipulate than is usually supposed. The chief difficulty, no doubt, is to get the water to boil properly; and the native explorers of the Indian survey are by no means always successful in overcoming this difficulty. At the same time, it is a matter of common experience that natives are adepts at the art of coaxing water to the boiling-point under circumstances that would utterly baffle any European operator. On the whole, they succeed fairly well. This is, at any rate, the method which is usually adopted for determining the heights of passes and points on the elevated plateau lands to the north of India by Indian surveyors.

Major Waddell has written a story which is not only interesting, but instructive. He is a geologist and a botanist, as well as a keen observer with artistic perceptions. The result is a book which adds, in a pleasant fashion, a great deal to our general store of knowledge about one of the most interesting "playgrounds" of the Himalayas.

THE BRITISH NATIONAL ANTARCTIC EXPEDITION.

At the meeting of the Royal Geographical Society on March 27, the President, Sir Clements Markham, made the following very satisfactory statement with reference to the progress of the subscriptions towards the equipment of a National Antarctic Expedition:—

"In my opening address this Session, in referring to the urgency of obtaining funds for an Antarctic Expedition, I expressed my conviction that the spirit which influenced the patriotic adventurers of the Elizabethan age was still alive among us. Many good men and true have answered to my appeal. But I now have the pleasure of announcing to you an act of unselfish liberality which does indeed remind us of the merchant princes of the days of old. Our associate, Mr. L. W. Longstaff, a Fellow of this Society of many years' standing, has subscribed a sum which virtually puts an end to our chief difficulty. We shall be enabled, at least, to equip an efficient expedition consisting of one vessel, and to co-operate with the Germans in the scientific exploration of the Antarctic Regions. You will like me to read to you the letter I have received from Mr. Longstaff, from which you will learn the noble motives that have actuated him, and the munificence of his contribution.

"'*To the* President of the Royal Geographical Society.

"'Dear Sir Clements Markham,

"'Being convinced of the imperative need of the immediate preparation of a British expedition, I have the pleasure to inform you that I have this day paid to the credit of the National Antarctic Expedition with Messrs. Cocks, Biddulph & Co. the sum of £25,000, which I trust will meet the exigency of the case.

"'Though my attainments are but slight, I have all my life been much interested in scientific matters, and as a Fellow of our Society for nearly thirty years, it gives me peculiar pleasure to be able thus to contribute towards the advancement of our knowledge of the planet on which we live.

"'I am, dear Sir Clements,
"'Yours faithfully,
"'LLEWELLYN W. LONGSTAFF.'

"'Ridgelands, Wimbledon, March 22, 1899.'

"I will now ask the meeting to pass a cordial vote of thanks to Mr. L. W. Longstaff, which I shall have great pleasure in conveying to him."

In connection with the above, it may be of interest to state that Mr. Longstaff's father, Dr. George Dixon Longstaff, was one of the Founders and a Vice-President of the Chemical Society. He himself was born in 1841, and was educated at the Wandsworth Proprietary School, under the late Bishop Staley, and studied chemistry at Frankfort-on-the-Main, and under the late Prof. A. W. von Hofmann at the Royal College of Chemistry. He was the first vice-chairman, and is still a director of Blundell, Spence, and Company, Limited, manufacturers and merchants. He has done much to improve the relations between employers and employed, and has established a pension fund for the employees of his firm. In 1880 he retired from the 1st East Riding of Yorkshire Rifle Volunteer Corps, with the rank of Lieut.-Colonel. Mr. Longstaff's well-timed liberality has made it possible to return a favourable reply to the inquiry in Baron von Richthofen's letter, which is given on a previous page. With the subscriptions received or promised from various quarters, the funds at the disposal of the joint Antarctic Committee now amount to £40,000. It is hoped and believed that Mr. Longstaff's generous example will be followed to a greater or less extent by others, and that in the end a sufficient sum may be obtained to equip a National Expedition worthy of the country.

THE MONTHLY RECORD.

EUROPE.

Rainfall in the Lake District.—Amongst the short papers prefixed to Symons' volume of 'Rainfall Tables for 1897,' is one on the mean annual rainfall of the English Lake District, which forms an almost perfect miniature specimen of skilful discussion of rainfall statistics, particularly in the way of showing how close approximations to true long-period means may be obtained from short or irregular records. The orographical map from Dr. Mill's paper on the Lake District is reproduced, and facing it is a map showing the mean annual rainfall, the isohyetals being drawn in thicker lines the greater the rainfall they represent—a distinct addition to graphic methods for this class of work. One of the most interesting points brought out by the discussion is the fact that the line of 100 inches encloses an area of not less than 70 square miles; and it is supposed that the 100-inch area may extend even further eastward than is shown—probably as far as Kentmere reservoir and Kidsty Pike. In both Langdale and Borrowdale the annual rainfall is shown to be nearly 130 inches. The rapid changes of rainfall within short distances are very remarkable; between Great Gable and the Stye, 1½ mile apart, the average difference is 71 inches, equal to 0·04 inch per yard. The paper is one of great importance in affording almost the first opportunity of investigating adequately the curious anomalies known to exist with regard to the distribution of the rainfall and the prevailing rain-bearing winds.

Loch Coruisk and the Coolin Hills.—In the summer of 1897, a party of members of the Scottish Mountaineering Club, under the guidance of Mr. W. Douglas, of Edinburgh, camped for some time at the head of Loch Coruisk, in Skye, and occupied their time in fixing altitudes and filling in the detailed work on the 6-inch Ordnance Survey map, as well as in feats of rock-climbing. Mr. Douglas published during last year, in the Scottish Mountaineering Club's *Journal* (vol. v. p. 1), a full account with illustrations of the life in this camp, and also the Ordnance Survey map of the Coolins, bearing in a special character the names and heights added by the mountaineers. Occasion was taken to make some soundings in Loch Coruisk, a small lake little over a mile in length, and surrounded by picturesque cliffs; the surface stands about 26 feet above sea-level. Five soundings were made in the upper part of the loch above a group of small islands, which may possibly mark a division into two basins, and the greatest depth observed was 96 feet, near the steepest part of the shore. In the centre two soundings, some distance apart, both showed 64 feet. A note by Mr. J. Rennie, on the magnetic properties of the rocks near Loch Coruisk, is given in an appendix. At one place, the bearings of a distant object, taken from two points not ten paces apart, but on different sides of a spur of rock, showed a difference of 57°, and in another place a difference of 6½° was observed.

The Influence of Lake Balaton on the Climate of the Surrounding Region.—In the fourth part of vol. i. of the *Resultate der wissenschaftlichen Erforschung des Plattensees*, the investigations into the climatic conditions, and especially the rainfall, of the district around Lake Balaton are described by Dr. Saringer and Herr Odon von Bogdanfy. The results of twenty years' observations of atmospheric pressure and temperature, wind, humidity, and rainfall at fourteen stations on the margin of the lake and in the neighbourhood are discussed, and besides other illustrations there are twenty-four rainfall maps for the whole of Hungary, specially prepared by the *Reichsamt für Wasserbau und Bodenverbesserung*. Notwithstanding the comparatively small size of the lake (less than one-ninetieth the area of Lake Michigan), the effect of its presence on the temperature of the surrounding region is very distinctly marked: the daily maximum is lowered by about 1° Fahr. on the mean of the year, while the daily minimum is raised by 1°·5 Fahr. on the same period, and more than 2° Fahr. during the summer months. Both the diurnal and annual range of temperature is less than in the rest of Hungary, and the raising of the minima being greater than the lowering of the maxima, the mean temperature is on the whole above the normal. The rainfall decreases somewhat from south-west towards north-east, the lake lying in the transition area between the humid districts to south-west and west, and the regions of small rainfall to the eastward. The amount of sunshine is relatively high, "rainy" days number only one in four or five.

Glaciation in the Rila Mountains, Bulgaria.—A valuable paper on the Rila mountains, with a special view to the traces still existing of a former glaciation of the range, is contributed by Dr. Cvijic to the *Zeitschrift* of the Berlin Geographical Society (1898, No. 4). The author, who is well known for his useful monograph on the phenomena of the "Karst," carried out, in company with three Bulgarian savants, a careful exploration of the range in the summer of 1896, starting from Samokov, on the north side of the mountains, and making a series of excursions through the upper valleys of the Iskar, Reka, and other streams, and across the intervening ridges, with the ascent of Mount Mussala, the highest summit of the Rila. Traces of glacial action were soon met with, and this subject fixed the attention of Dr. Cvijic throughout the whole trip, by reason of the interest attaching to it from the fact that the phenomenon has been denied to exist in the Balkan peninsula. He also studied the general orographic structure and hydrography of the range, and the first section of his paper gives a clear account of it from these points of view. The second discusses in detail the traces of former glaciers discovered and their relation with the present extent of névé in the range. The Rila possesses no continuous covering of snow, as its highest peaks do not reach above the climatic snow-line. The abundance of snow which has struck most travellers is due to the perennial patches of névé, found chiefly in the *Kare*, a feature characteristic of the range, to which Dr. Cvijic devotes special attention. They are described as broad semicircular niches, occurring at the head of the valleys, with a steep wall above, but open in the opposite direction. Their floors are generally flat, often containing pools of water held in by ridges of rock or by moraines. The valleys generally fall in a series of steps, of which the *Kare* form the highest member. They are generally found in association, and are in that case separated by sharp ridges of rock. Of a total of about thirty-two in the range, twenty-five face the north and seven the east, so that they are restricted to these sides of the ridges. All occur above the limit of trees. It is in the *Kare* that the chief traces of glaciation are found, and these are specially abundant in the *Kar* of Edi-jol (Seven lakes), of which (as of some others) an enlarged map is given with the paper. The general map, which is coloured according to contours, shows all the *Kare*, as well as the moraines, *roches moutonnées*, and other vestiges of glacial action. The Rila is the most southern point in Europe where traces of an ice-age have been found, and, as might be expected, such occur only in the upper region, the former snow-line being placed by Dr. Cvijic at about 7000 feet.

The Glaciers and Forests of the Western Caucasus.—The preliminary report on a journey in the North-Western Caucasus, made in 1896 under the auspices of the Russian Geographical Society, is given by N. A. Busch in the two last numbers of *Petermanns Mitteilungen* for 1898. The special object of the journey was the investigation of the glaciers and vegetation of the upper parts of the little visited valleys on the north side of the Western Caucasus west of the Klukhor pass, traversed by tributaries of the Kuban. They were reached by way of Batalpashinsk and the Aul Teberdy, where the preparations for the separate excursions were made. The first continuous forests in the Kuban valley were reached near the village of Khumara, where the hillsides are tree-clad. As has been found elsewhere on the western flanks of the Caucasus, a forest zone of deciduous trees of the ordinary European type is first found, and conifers first appear in any numbers higher up the valley. The first valley explored was that of the Great Selenchuk. Beech woods of the character of a primeval forest were here met with. The upper valley bears the name of Psysh, from the conical peak of that name, 3787 metres (12,261 feet), which closes it in. A glacier was discovered at the head of the valley, and two at the source of the Sofja, a tributary stream so named by the Abkhasians who formerly dwelt here. The principal glacier is said to have retreated of late years. The woods of these upper valleys consist either of pines or of firs and spruces, intermixed with deciduous trees and brushwood. At the source of the Psysh, a forest of firs has quite a primeval character, and the Aurochs is said to have formerly roamed there. It is at no great distance from the Sagdan valley, where they still exist. The next valley visited was that of the Axaut, previously undescribed, though an easy path up it was found. Pine forest, broken by small meadows, extends to its head, where there are two glaciers of the first class longer than that of Marukh (at least 3 miles according to Dinnik). That at the western source is said to have retreated 700 yards since about 1870. Other glaciers were examined in the valleys of the Teberda and Marukh, some of which had been previously visited. One at the source of the Alibek, a tributary of the Teberda, was also almost equal to the Marukh glacier. Herr Busch crossed the Marukh pass and examined the great Shkaltre glacier, afterwards making his way to Sukhum Kale by the route followed by General Babich's army in 1878. In all thirty glaciers were visited, while a large botanical collection was made, as well as a botanical map of the Kuban region. The latter shows the wide distribution of pine and birch woods, which seems to coincide with the region of dark brown quartz-conglomerates, while the eruptive formations are clothed with firs. The aspect of the slopes does not appear to affect the forest distribution. On the west flanks of the Central Caucasus the deciduous forests clothe the Jurassic belt; the crystalline schists are bare, while the coniferous woods are found in the granitic glens near the glaciers. The old Russian 5-verst map was found very inaccurate in some places, especially in the region of the upper Axaut and great Selenchuk. The new 1-verst survey is not yet, we believe, complete for the Western Caucasus, although extracts from it, showing in detail the glacier sources of the Teberda, were, by permission of the staff, published by Mr. Douglas Freshfield in 1896. Herr Busch, strangely enough, makes no reference to its existence, although several of the glaciers he describes (Dombai Ulgen, Ptuish, Amanauz) are shown in the portion published by Mr. Freshfield. Herr Busch was more of a horseman than a mountaineer, and more of a glacier student than a glacier explorer. His studies were, consequently, mainly confined to the lower extremities of the ice-streams. He gives few accounts or measurements either of the mountain crests or the upper *névés*. From his narrative it appears that the chief glaciers west of the Klukhor pass attain an average length of 5 versts (3⅓ miles). This is the length attributed by the new Russian map (1 verst to the inch) to the Amanauz glacier, which Herr Busch believes to be the largest in the district. It is to be hoped that some competent mountaineers may visit and give us a more comprehensive description of the scenery and summits of this interesting region, and of the high-lying glacier fields, resembling those of the Adamello, conspicuous from the Black sea in fine weather.

Was the Kalmuck Steppe formerly wooded?—In the eighth number of the current volume of *Globus*, Prof. Nehring, of Berlin, discusses the question of the former existence of woods on the present Kalmuck Steppe, near Astrakhan. Recent investigations have, he says, proved that woods once covered much larger areas in the steppes of South Russia than at present, and he is inclined to believe that the same was the case in the region of the lower Volga. He bases this opinion on the recent discovery near Luchka, on the right bank of the Volga, 25 miles below Sarepta, of fossil remains of various animals, which elsewhere show a decided preference for partially wooded districts. The formation in which they were found seems not fluviatile, but a sub-aërial deposit resembling loess, while the remains show no signs of transport by water, so that Prof. Nehring thinks it almost certain that the animals actually lived in the neighbourhood in which the bones were found. The best-preserved relic is the scull of a bison, more nearly allied to the *Bison Europæus* than to the *Bison Priscus* of the German *diluvium*, and apparently very like the bison of the Caucasus. The next specimen is the antler of a stag, which is interesting because no such animal has previously been known to exist in these parts north of the Kuma. Prof. Nehring is inclined to identify its owner with the maral of the Caucasus. Another antler belongs to a species of *Megaceros*, the genus to which the Irish elk belonged, while the last animal represented is the mammoth. From the presence of the two last, Prof. Nehring concludes that the former character of the district was that of a steppe alternating with patches of wood.

ASIA.

Dr. Futterer's Travels in Eastern Asia.—Writing from Hankau on January 26, Dr. Karl Futterer sends us the following summary of the last stage of his great journey across Asia, which supplements his letter from Liang-chou referred to in the *Journal* for November, 1898 (vol. xii. p. 520): "From Liang-chou, travelling with mules, we took the high-road to Sining-fu, and then continued our journey for some distance up the valley of the Sining-ho, where we completed the preparations of our journey into Tibet with yaks. We reached Koko-nor in August, and turned southwards from about the middle of the lake-shore across the South Koko-nor mountains to the Dabassu lake, and, turning eastward along the great range on the south of that lake, crossed the range and reached the Hwang-ho at the Djupar mountains. We followed the Djupar range to the south-east by the Baa river, and a series of hitherto unexplored rivers and mountain chains which run in a westerly direction to the Hwang-ho. We halted on one of the largest of these, the Shtsetse river, on August 15, and thence made an excursion southward as far as the Hwang-ho, which we reached, travelling with horses and very little baggage, in four days. At the point where we reached it, the great river flows from east-south-east to west-north-west through a broad valley with high terraced walls of alluvium on the left side. On the left side of the valley, a few kilometers distant, a very high snow-covered mountain range runs parallel to the river. Nothing was to be seen of the bend of the Hwang-ho valley from this point, and there was no way along the river nor any means, such as a ferry or bridge, for crossing the broad stream. We returned to the camp on the Shtsetse river, crossing on our way, on the right bank of the Hwang-ho, a mountain of Palæozoic coral limestone, and several chains of ancient sandstones and schists, all of which had a west-north-west strike. We then resumed our former direction of march to the south-east and east parallel to the Hwang-ho valley, but at some distance from it, traversing high mountainous country and crossing one pass of about 13,000 feet. We reached the valley of the upper Tao-ho on November 8, and two days more on horseback would have brought us to the Hwang-ho, which we should have met at a short distance from the road leading directly eastwards from the Hwang-ho to Sung-pan-ting. Our yak caravan could have reached Sung-pan-ting in twenty-five to thirty days, but on account of an attack by Tibetan bandits at the monastery of Shinse, on the upper Tao, that journey had to be abandoned. In the fight several Tibetans were wounded, but our yaks and horses were driven away; the goods and collections were fortunately saved. The expedition succeeded in descending the Tao valley with all the collections, and reached Tao-chau on November 21, whence the expedition started on its return through Western China to the coast. We travelled by Min-chou and Ping-ling-fu to Singan-fu, and thence over the Sing-ling mountains to the Tan river, which was reached on December 31. The valuable scientific collections were conveyed by mules to Lungkuchai, where they were shipped in two boats on the Tan river. The boat journey commenced on January 2, and on January 12, at Sahokeo, on the Han river, they were transhipped to a larger vessel, and all arrived at Hankau on the 24th. We are now on our way home by Shanghai and America. The whole of our routes in the hitherto unexplored portions of North-Eastern Tibet have been surveyed topographically and geologically; the meteorological observations will be kept up until we reach Shanghai, but the geological survey ceased at the commencement of the river journey. I hope to pass through London about the end of March, on my return to Germany."

Dr. Cholnoky's Physical-Geographical Researches in China.—The first number of *Petermanns Mitteilungen* for 1899 contains the preliminary report by

Dr. Cholnoky on the scientific results of his journey in China, an outline of which was given in the *Journal* in May last (vol. xi. p. 547). Dr. Cholnoky's attention was principally directed to the geotectonic structure of the regions visited, and he puts forward some new ideas with regard to the mode of formation of the present surface features, the origin of the laterite, and so forth. His investigations relate chiefly to three regions, viz. the plain between Hangchau and the lower Yang-tse; Southern Manchuria; and the region of the lower Hwang-ho. In the first of these, he paid particular attention to the geographical history of the Tai-hu lake, and his observations tend to refute the idea of Richthofen and Edkins that the Yang-tse once passed through this lake on its way to the sea. Even at low water the lake is decidedly above the level of the sea, to which it is drained in all directions, while Dr. Cholnoky's inspection of the line of ground between the alluvial plain of Tai-hu and that of Wu-hu on the Yang-tse, led him to conclude that, though traversed by an artificial canal, it has never been crossed by a river-channel since the deposition ot the laterite. In Manchuria Dr. Cholnoky found that, as in China, the mountain chains have a north-east direction, while, as shown to be the case by Richthofen for the north Chinese ranges, only the Palæozoic strata are affected by the forces which raised the mountains. Two distinct lines of recent volcanic action were observed, one of these being marked by an extensive plateau of basalt, which occurs just in the same latitudes as the American trap plateau of Canada, Idaho, and Oregon. It occupies the whole upper basin of the Sungari, and is diversified by lines of basaltic volcanoes, which have the appearance of a continuous mountain range. The Chang-pei-shan range, along the north frontier of Korea, which cuts across the Sinic system from east to west, is certainly older than the latter, and Dr. Cholnoky is inclined to connect it with the Kuen-lun system. The existing maps of Manchuria contain many inaccuracies; even James's, which is the best, places O-mó-so 50 miles too far north. The river at Kirin is not correctly named Sungari, which name is used only after the junction with the Nonni. Its real name is Son-hoa-kiang. Between Mukden and Shan-hai-kwan, Dr. Cholnoky was struck by the vast plateau of abrasion, in which the streams have cut as deep channels as in the loess, while in his subsequent journey across the Hwang-ho to the Hwai range, he found similar characters in the plateaux traversed, and considers that these all belong to one system of recent marine abrasion, which extended from Liau-tung to Swa-tau, and even to Singapore. A remarkable fact is the association of the laterite with these plateaux of abrasion, the material of the former agreeing with the rocks of the latter in proportion to the nearness of the two. Dr. Cholnoky therefore suggests that the laterite, which cannot be the product of decomposition *in situ*, is due to a deposit, in sea-water, of atmospheric dust from a parallel zone of deserts, mixed with the products of abrasion. In the great Chinese plain, Dr. Cholnoky distinguishes the following three parallel zones: (1) the plateaux of abrasion; (2) the cones of detritus of the rivers; (3) the zone of the deltas. He devotes special attention to the second of these, which is the largest and most important, giving an impressive account of the cone of detritus of the Hwang-ho, the largest in the world.

Meteorological Observations in the Turfan Depression.—The well-known explorer, Roborovski, was commissioned by the Russian Geographical Society, a few years ago, to establish a meteorological station at the small town of Lukchun in the Turfan depression, and observations were taken regularly from December, 1893, to October, 1895. M. de Tillo gives, in the *Comptes Rendus* (1899; part i. p. 154), a summary of the results obtained, pointing out their great interest as relating to a region the most continental in the world, and yet with a negative altitude. He first gives the mean values of atmospheric pressure and temperature observed for each month of the above-named period, afterwards showing the results obtained for the separate months by reducing the observations to sea-level, and making other necessary corrections. Side by side with these results, the values estimated by Buchan, in his report on atmospheric circulation issued in 1889, are shown. The principal conclusions are as follows: (1) The centre of high pressure occurs, during the months of November, December and January, in the Turfan depression, and not near Irkutsk; (2) the summer temperature is considerably hotter, and the winter temperature colder, in the Central Asian depression than has been estimated by Buchan; (3) the extreme annual range of the barometer yet known on the surface of the globe is that observed at Lukchun. In 1894 the difference between the means of pressure in January and July amounted to 1·1 inch, and in 1895, to 1·14 inch; while the maximum value, as given by Hann in 1897 for Semipalatinsk, was 0·73 inch.

Russian Expedition to Central Asia.—The Russian Geographical Society is fitting out, with the aid of funds supplied by the Tsar, a new expedition for the exploration of Central Asia. The expedition, the work of which is intended to cover two years, is to be under the command of Lieut. Kozlov, and will leave St. Petersburg at the end of the present month. It will make its way through West Mongolia and the desert of Gobi, will cross the Nan-shan mountains by Lake Koko-nor, and penetrate into the region lying round the upper waters of the Yellow river.

AFRICA.

The Great Nile Reservoir above Assuan.—The great undertaking to which the Khedive's assent was obtained last year, was publicly inaugurated on February 12 last, on which day the foundation-stone was laid by H.R.H. the Duke of Connaught. During the last few months the contractors, Messrs. Aird & Co., have made much progress with the necessary preparations for the work, and the first cataract is now the scene of bustling activity, no less than five to six hundred European officials and workmen being employed, while five thousand natives are at work quarrying and preparing the stone, which is obtained near the spot. The Nile at the first cataract is about a mile wide, and the channel is broken at low water by a labyrinth of rocky islets and ridges. It is on this foundation that the great dam will be built. It will be over a mile long, 80 feet wide at the base, and the top will be 90 feet above low water-mark. It will be pierced with one hundred and eighty sluices for the regulation of the flood waters, and will raise the level of the river for 140 miles above the first cataract. The chief consulting engineer, Sir Benjamin Baker, is said to have estimated that the work will be completed in two years, but other subsidiary barrages have to be constructed at Assiut and at Cairo, so that a longer time will be required before the whole scheme can be completely carried out. When this is done, a large area will be added to the cultivable lands of Lower Egypt, and even in Upper Egypt additional irrigation facilities will be secured at the time of high water. It is said that the ruins at Philæ will be in no way injured by the raising of the Nile level, for, according to the revised plans, this will be 18 feet lower than was originally proposed.

Journeys of Father Adams North and East of Lake Nyasa.—Two papers by Father Alfons Adams, apostolic missionary on Lake Nyasa, published (with maps) in the fourth number of the *Forschungen aus den Deutschen Schutzgebieten* for 1898, add to our knowledge of the districts north and east of the upper part of the lake. The first deals with the western parts of Uhehe, which Father Adams traversed by two different routes, afterwards proceeding south to the north end of Lake Nyasa. He gives a general sketch of the physical features of the country, enumerating in particular the principal streams which, taking their rise in it, make their way north and west to the Ruaha. During the rainy season, which here lasts generally from November to the end of May, these streams overflow their banks, forming extensive swamps. The fauna of the region is particularly rich, though unevenly distributed; birds are especially abundant. Ubena, which occupies the western extremity of the district, is a gently undulating plateau, now almost devoid of trees, and in great part uninhabited since the last war. South of it lies the more elevated and mountainous district of Kirougi, occupying the water-parting between the headwaters of the Ruaha and Ulanga. Granite is everywhere the fundamental rock. The second paper describes a route from Manda bay, on the east shore of Lake Nyasa, across the southern Livingstone range to the region of the Luvegu, the southern tributary of the Rufiji. Although in part coinciding with Ramsay's route of 1894, it diverged considerably to the north, through the previously unvisited districts of Mgende and Upogoro, crossing and recrossing the Luvegu in the central part of its course. After passing through the mountainous country near the source of this river, Father Adams entered, by a series of descents, a more undulating district, broken, however, towards the north by the high table-topped summits of Keyu and Hani. The southern and western parts of Mgende are much cut up by gullies, washed out by torrents in the soft red and yellow sandstone. The whole country south-east of the Luvegu is uninhabited, and covered with light woods or bamboo jungle. Game is very scarce. The Luvegu flows almost entirely through a narrow valley, although near the junction of the Mbarangnandu, its largest tributary (from the south), it has low sandy banks and a considerable breadth even at mean water-level. Below this it is again hemmed in between well-wooded banks. Uporogoro is a romantic mountainous country with luxuriant vegetation, and of surprising fertility; it gives rise to various feeders of the Lorembero, which itself rises in the Sesse range, and joins the Ulanga above the mouth of the Luvegu. In its lower course it passes through a wide plain. During Father Adams' three weeks' stay at Isongo, which lies among the mountains at a height of 2500 feet, the whole landscape was wrapped, from 7 a.m. till midday, in dense mists, which rose from the lowlands of the Ulanga and Lorembero. The inhabitants are shy, and build their huts in rocky ravines or hollows, often accessible by a single passage only.

Ascent of Mount Rungwe, Northern Nyasaland.—The *Deutsches Kolonialblatt* for December 15 last contains the account of the ascent, by Herr von Elpons, commandant of the German station of Langenburg, of Mount Rungwe, the highest summit of the mountainous region north-west of Lake Nyasa. The way led at first over a broad grassy tract, with flowers and ferns often resembling those of Europe. An antelope, francolin, wild doves, etc., were seen here. As the ascent became steeper, deep gullies appeared on either hand, clouds obscuring the view. Forest and bamboo thickets were next traversed, and the party reached the foot of the final peak, the ascent of which was very steep. Ferns and brushwood still grew luxuriantly. The altitude was fixed by boiling-point observation at about 10,200 feet. Other high peaks were seen to the north, in which direction Mount Rungwe falls steeply into a gloomy cauldron-like valley, which had all the appearance of a crater. A rift 300 feet broad was seen on its floor, but to what depth it extended, or what was its character, could not be ascertained. The descent was made towards the south-west, but at nightfall the party found themselves in a narrow and deep ravine, where they were forced to spend the night without the means of cooking food, at a temperature of 43° Fahr. It was only after great difficulties that a way was found the following day, down an almost perpendicular wall of rock. The whole mountain is saturated with moisture, and gives rise to numerous brooks and streams. The soil is deep black humus, in which bamboos grow to a very large size.

Map of the Interior of Togoland.—In 1896 a map of the southern portion of the German territory of Togoland was compiled by P. Sprigade on the large scale of 1 : 200,000, and issued with the third number for that year of the *Mitteilungen aus den Deutschen Schutzgebieten.* It embodied the results of all the surveying work done by German explorers up to that date, and gave a detailed view of the topography of the region dealt with. The same cartographer has now prepared (*Mitteilungen*, 1898, part 4) a map of the northern interior of Togoland, for which likewise a large amount of material is now available, thanks to the labours of the many German pioneers who have penetrated to the more remote parts of the territory. The routes are here, of course, less thickly strewn than further south, so that the scale of 1 : 1,000,000 amply suffices to show clearly the existing state of our knowledge, and even so, few parts of the African interior have yet been so thoroughly mapped. The map embraces the area between 7° and 13° north, extending to Say on the Niger in the north-east, and including on the west the whole of the neutral zone north of the Gold Coast, as well as the greater part of Mossi and Gurunsi in the French Sudan. All the routes of German travellers are shown, as well as the principal French routes; those of British officers behind the Gold Coast have, unfortunately, so rarely been published that, with the exception of those of the Mulatto Ferguson, they are not available. The work of exploration in Togoland has been of the systematic detailed character which fails to attract public attention by the presentation of geographical novelties, and on this account the publication of its results in a comprehensive form is of particular value.

AMERICA.

Mr. Low's Explorations in Labrador.—Dr. Dawson, Director of the Geological Survey of Canada, has received an interesting letter from Mr. A. P. Low, of the Survey staff, dated at Great Whale river, on the east side of Hudson bay, December 30. Mr. Low, whose exploratory work in Labrador has made his name well known, set out on the present mission early in June last. The letter tells of his safe arrival at Great Whale river, and of the successful completion of his survey of the eastern coasts of Hudson bay from Cape Wolstenholme southward to Great Whale river. Dr. Dawson had not heard from Mr. Low since the end of July last, when the surveyor left the Hudson bay steamer *Erik* in his yacht to enter upon his work. The last letter has just arrived in time for inclusion in the summary report of the survey now going through the press. It appears that Mr. Low has made an accurate log survey of about 500 miles of coast-line, of which about half is entirely new, never having been previously charted except in the roughest way. Mr. Low confirms the reports as to the existence of cod in the north-eastern part of Hudson bay, although he is unable to speak of the extent or value of the fishery. His letter contains further information respecting the valuable deposits of magnetic iron ores previously known to exist upon the shores of Hudson bay. He ends his account of the summer's work by stating that, having taken with him a pair of skis, he found them much better adapted for travel on the snow in that part of the country than the snowshoes ordinarily employed. He adds that the Eskimo in the vicinity of the Hudson bay post at Great Whale river are devoting themselves to making and learning to run upon skis. Mr. Low has planned to carry out some extended explorations in the Ungava region, in the latter part of the winter and before the opening of navigation. He hopes to continue his work in the northern part of Hudson bay before returning by way of Moose river. His letter reached Ottawa by way of Moose Factory, Abittibi lake, and Lake Temiscamingue. Mr. Low, upon leaving Ottawa last summer, proceeded to Quebec, where he outfitted and took passage on the Hudson bay schooner which goes every year to Rigolet, on the Labrador coast, and there waited for the *Erik*, which comes from England. He went on the *Erik* to Nachvak, further north on the coast, where he had left his yacht upon returning from Hudson strait the previous year. The yacht was placed on the deck of the steamer and conveyed to Cape Wolstenholme, where Mr. Low parted company with the steamer and began his survey work.

Journey to the Mouth of the Mackenzie.—M. E. de Sainville, who between 1889 and 1894 made some extensive journeys in the extreme north of the North-West Territory of Canada, gives in the *Bulletin* of the Paris Geographical Society (part 3, 1898) some notes on the geography of the region of the Mackenzie delta, with a map which differs in many ways from former maps of the same country. Of the delta itself and the modifying agencies at work there, he gives the following account. The three main channels are united by a network of smaller ones, forming a number of low islands covered with firs and willows. At the breaking loose of the waters in spring, barriers of ice are formed between the islands, raising the level of the water, so that the estuary then has a width of 40 miles. As soon as the banks of sand and mud, which are brought down in enormous quantities, rise above the mean height of the water, willows begin to grow rapidly, and, arresting the passage of driftwood, give rise to the formation of new islands. This is now taking place to the west of Richard island, where was open sea during last century. East of the delta, M. de Sainville was able to correct the map of the Abbe Petitot, based for this part chiefly on native information. From the eastern branch of the Mackenzie a route leads by a series of portages to the Natoja river, which enters Eskimo lake, a deep expanse of water 30 miles by 5 or 6. It is discharged through a series of brackish lakes into the head of Hutchinson bay. The coast-line hereabouts is shown by M. de Sainville quite differently to its outline on our maps. The so-called Island of the Geographical Society seems to form part of the mainland, for Hutchinson bay has no connection either with Liverpool bay to the east or with the sea east of Richard island in the opposite direction. The whole of this neighbourhood is entirely composed of sand and ice, not a rock being seen even on elevations of 500 feet. Blocks of ice are often found 100 to 200 feet above the general level, and fossil remains of elephants are plentiful. M. de Sainville found the head of one in perfect preservation. The banks of the two rivers which enter the head of Hutchinson bay are covered with firs, similar to those which grow on the Mackenzie south of 68° 30′. This region, like the Mackenzie delta, is well to the north of the line usually shown as the limit of woods. M. de Sainville recommends Hutchinson bay as the best winter quarters along the whole coast, as the ice breaks up early, and he thinks that any expedition to the northern magnetic pole would do well to proceed to this bay by way of Bering strait, and, wintering there, start onwards in July. The paper includes some account of the mountainous region of the Peel river, west of the Mackenzie. The writer was able, after great hardships, to ascend almost to the source of the Peel, where it is a rapid torrent, and separated from the Yukon basin only by a portage of about 10 miles. Neither the map nor the account, however, gives any indication of the latitude reached. M. de Sainville concludes with observations on the natives, fauna, etc., of the country. The extremes of temperature recorded were 98° and −67° Fahr.

The Proposed Nicaragua Canal.—The preliminary report of the Nicaragua Canal Commission, relative to its progress in investigating the question of the proper route, the feasibility and cost of construction of the Nicaragua canal, has just been issued. With a view of making a complete and exhaustive report on the subject, this commission visited Nicaragua, personally examined the entire canal region from ocean to ocean, and employed some seventy engineers, with their labourers and helpers, for ten months in making careful surveys and examinations of the canal region. Some meteorological and hydrological observers are still continued in Nicaragua, with a view to obtain a full year of observations of that nature. The required field work has been obtained, and its reduction, together with the compilation and comparison of former surveys, going back nearly fifty years, has been in progress for more than two months. The estimates for two of the best-known characteristic routes have been nearly completed. These routes are known as the Maritime Canal Company's route and the Lull route. A canal of smaller dimensions, sufficient only for present needs, is being estimated for. It is the opinion of the commission that, of the two routes mentioned above, the one called the Lull route is the more desirable, as it is easier of construction, presents no impossible engineering difficulties, and will be a safer and more reliable canal when completed. The commission believes that the construction of a canal across Nicaragua is entirely feasible.

Dr. Steffen's New Expedition.—The zealous explorer of the Andes of Patagonia, Dr. Steffen, started in November last on a new expedition, to complete the work previously done by him in those regions. A note in the *Geographische Zeitschrift* (1899, No. 2) announces the programme which Dr. Steffen sketched out for himself before starting. After examining the fiords of the coast between 46½° and 48° south in order to determine the best waterway into the interior, he hopes to follow the course of this stream, which may be expected to issue from Lake Buenos Aires, or some other of the partially explored lakes to the south. He also hopes to throw light on the connections of Lakes Cochrane and San Martin, the latter of which has lately been supposed to be drained into the Pacific ocean.

AUSTRALASIA AND OCEANIC ISLANDS.

Mr. Levesey's Journey in British New Guinea.—In his despatch dated November 28, 1898, the acting Administrator of British New Guinea, Mr. F. P. Winter, refers to a trip recently made by Mr. Levesey and his son into country not previously visited by Europeans. He ascended the so-called Tauri and Lakehamu rivers* (which flow into the Gulf of Papua in the vicinity of Port Chalmers) into the hills, and travelled over some mountain country at their heads. The Tauri had apparently changed its course more than once. There was excellent land on this river, and some large red cedar trees were seen near its upper waters. On the top of a hill, judged to be over 3000 feet high, a remarkable discovery was made of a large coral reef which stood out so clean cut, and so hard and solid, that it appeared as if it had only emerged from the sea a short time previously. Alongside the coral wall was a bank of sand containing fragments of coral and shells. On neither the Tauri nor the Lakekamu rivers, nor in the hills, did Mr. Levesey see the least trace of man after he had got beyond the district frequented by the coast tribes. Mr. Levesey went up the Biaru river, until he met with a tribe who called themselves the Omwom. So far as he could understand, these people were at one time settled on the coast, but were driven inland by the Gulf natives some time before this country became a British possession. They appeared hospitable.

The British Solomon Islands.—Mr. Woodford's Report on the British Solomon Islands Protectorate for the period January, 1897, to March, 1898, inclusive (Colonial Reports, Annual No. 251), is to hand. Two new items of export are included in the statement for 1897, viz. rattans, used in New South

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* See Plan 4B, New Guinea Annual Report, 1892–93.

Wales for making coal-baskets, and plants, mainly consisting of an orchid (*Dendrobium speciosum*). The climate of the islands appears suitable for the growth of coffee; Savo is considered eminently adapted for this product. A well-equipped expedition visited the Protectorate during the past year from San Francisco, with the object of prospecting for minerals. They, however, met with little success, the mineral wealth of the islands having been falsely represented. The Solomon group is apparently free from hurricanes. The rainfall varies considerably in different localities. Maran sound, at the south-east end of Guadalcanar, is, during the south-east season, probably one of the wettest coast places in the Protectorate; this is, no doubt, owing to the configuration of the island. On the other hand, the Government station at Tulagi hardly has its due share of rainfall. The greatest quantity of rain registered in one day at Tulagi was 4·93 inches on March 1. The highest temperature registered by Mr. Woodford at or near sea-level was 92°, while the lowest night temperature registered at sea-level, on the north coast of Guadalcanar, was 74°. The Government buildings are now practically completed. A Protectorate has been proclaimed over the islands of Rennell, Bellona, and Sikiana, or Stewart island, and are now included in the British Solomon Islands Protectorate.

The Exploration of the Ottilien River, German New Guinea.—We have already announced that the expedition sent to explore the Ottilien river in German New Guinea, has been successful in proving the identity of that stream with the Ramu, discovered in the interior by Dr. Lauterbach. Lieut. Tappenbeck's report on the proceedings of the expedition has lately appeared in the issue for 1898 of the *Nachrichten über Kaiser Wilhelms-Land*, and the most important sections of the report have been reproduced in the first number of the *Verhandlungen* of the Berlin Geographical Society for the current year. The bar of the Ottilien was safely crossed by the steamer, with a depth of 13 feet, on April 13, 1898. The banks were found to be quite level, and covered with dense vegetation, casuarinas being at first abundant, but giving place later to Nipa palms. No suitable spot for a station could be found. There are no permanent villages on the lower course of the stream, only shelters erected by natives from the interior while on fishing expeditions. The current is here extraordinarily strong, and the average depth in the channel 26 feet. On the second day natives were seen, whose canoes resembled those of the upper Ramu. On the third the forest became higher, and gave the impression that the soil was less damp. Many crested pigeons were seen, while in the mornings and evenings birds of Paradise were heard in large numbers. On April 18, the first coconut palms were seen, and a village was soon reached, which the leader thought to be the turning-point of the former expedition. This was to some extent confirmed by the fact that the natives at once took to flight when Lieut. Tappenbeck took up a carbine after the manner of a walking-stick, without making with it any threatening demonstration, which showed that they were acquainted with firearms. This was the furthest point reached, as the steamer appeared too heavily laden for a further advance against the strong current. It was, however, proved that a vessel of 9 feet draught can navigate the stream for a distance of at least 110 nautical miles, for the repeated groundings were due to ignorance of the course of the deep channel, and can be avoided after this is laid down by more careful surveys.

POLAR REGIONS.

Mr. Borchgrevinck's Expedition.—Telegraphic intelligence from New Zealand, received in this country on March 17, announces the arrival of the *Southern Cross* at Port Chalmers, having landed Mr. Borchgrevinck and his party, eleven in all, at Cape Adare, Victoria land.

The Andrée Expedition.—At the request of Prof. Nordenskjöld, the King of Sweden and Norway has provided Mr. F. R. Martin with 1500 kroner to enable him to conduct a search for Herr Andrée in Siberia. Mr. Martin has already started his journey.

GENERAL.

Sebastian Cabot.—In Mr. Winship's letter on "Sebastian Cabot," p. 208, line 15 from bottom, for *source* read *power*.

OBITUARY.

Sir George Ferguson Bowen, G.C.M.G.

ANOTHER of the great colonial governors whose names are so intimately connected with the early days of the British settlements in Australasia, has passed away in the person of Sir George Bowen, who succumbed to bronchitis after only two days' illness on February 21 last. The deceased was one of our older members, having joined the ranks of the Society forty-five years ago, and being a contemporary on its roll of our present President and of Mr. A. R. Wallace. He occasionally took part in discussions at the evening meetings, and served on the Council from 1889 to 1892.

Sir George Bowen's connection with Australia did not begin in early life, for after a distinguished career at Oxford, where he was twice President of the Union, he was in 1847 appointed President of the University of Corfu, that island being then, like the rest of the Ionian islands, a British Protectorate. This was the beginning of a period of work in Eastern Europe, during which he was called upon to play an important part in the affairs of that region. In 1858, as secretary to the Government of Corfu, he was associated with Mr. Gladstone in the inquiry into the constitution of the islands, which led to the adoption of various reforms in the government, though not immediately to the wished-for union with Greece. For his services in Corfu Bowen was made a K.C.M.G., and in 1859 was appointed Governor of Queensland, then first raised to the rank of a separate colony.

In this sphere, which contrasted so strongly with that he had just left—although he found many analogies between the life and surroundings of the settlers and those depicted by the classical writers—Bowen proved equally successful, attacking the problems which there faced him with characteristic enthusiasm and untiring energy. His sympathy with all classes made him universally popular, and on the expiration of his proper term of office his tenure of it was prolonged for two years. Among the subjects that especially engaged his attention, pioneering work and the formation of new settlements naturally took an important place, and in connection with these objects geographical exploration found in him a ready sympathizer. The exploration of the Burdekin river, the various expeditions in search of the missing explorers Burke and Wills, the formation of the new settlement at Rockingham bay, with explorations in its neighbourhood, all belong to the period of Sir G. Bowen's governorship, while he himself took part in an expedition which led to the formation of a coaling-station and settlement at Cape York.

In 1867, on the retirement of Sir George Grey from the Governorship of New Zealand, Bowen was appointed his successor, and by his tact and conciliatory attitude succeeded in completing the pacification of the islands after the second Maori war. He subsequently held similar appointments in Victoria, Mauritius, and Hong-Kong, in all of which he proved himself a successful administrator. His tenure of office at Hong-Kong included the period of the Franco-Chinese war, which rendered necessary the utmost vigilance and tact on the part of the Governor of the British settlement. On his return to this country in 1885, he was sworn a member of the Privy Council, and his last public service was the inquiry into the working of the new constitution at Malta, which he carried out in 1888, in conjunction with the late Sir G. Baden Powell, and for which he received the thanks of the Queen.

Sir George Bowen married, in 1856, the daughter of Count Roma, President of the Ionian Senate, and after her death in 1893, married a second time in 1896.

Sir R. Lambert Playfair, K.C.M.G.

We record with much regret the death of Sir Lambert Playfair, which took place at St. Andrew's on February 18 last, at the age of seventy years. Although not a professed geographer, Sir Lambert was one of those public servants whose long residence in foreign countries gives them exceptional facilities for observation, and who, by making the best use of their opportunities, are able to shed valuable light on the countries and peoples with whom they are brought in contact.

Sir Lambert Playfair was a native of St. Andrew's, being the son of the late Dr. George Playfair, and grandson of Principal James Playfair, of St. Andrew's University. His foreign service began at the early age of eighteen, when he entered the Madras Artillery. While still a lieutenant in that force, he was chosen by Sir James Outram as his assistant when, in 1854, the latter took up his duties as first political resident at Aden. Playfair had already qualified as an interpreter in the Arabic language, and he put his residence at Aden to good account by researches into the history of that part of Arabia, which were embodied in an official publication forming a part of the Bombay series of records. The volume contains an account of the ancient reservoirs at Aden, the restoration of which was commenced during Playfair's residence at the place. He also took his share in the measures for putting down the traffic in slaves between Arabia and Somaliland, and in the events connected with the British occupation of Perim. In 1863 he became political agent at Zanzibar; and in 1867, on retiring from the army with the rank of lieut.-colonel, became Consul-General at Algiers, holding that office until his retirement in 1896. During this long period he acquired an extensive knowledge, not only of Algeria, but of the Mediterranean countries generally, journeying, among other places, in the Balearic isles and in Tunis, where, in 1876, he visited the previously almost unknown Khomair country. In 1878 he contributed to Murray's series of handbooks the volume on 'Algeria and Tunis,' which was acknowledged to be one of the best so far issued; and in 1880 he described for the same series the Mediterranean generally, with its cities, coasts, and islands. Both these have passed through several editions. His official reports likewise contain much interesting information: that on his visit to the Isle of Jerba, the dates of which are identified by him with the lotus of Homer, deserves special mention. During his residence at Algeria, he paid much attention to the history of early British relations with that country, and in 1884 described the same in his volume, 'The Scourge of Christendom,' based largely on official documents.

At the British Association Sir Lambert Playfair, besides his address as President of Section E at Leeds in 1890, on the Mediterranean, Physical and Historical, gave several papers, describing his travels or discussing the political condition of Algeria and Tunis. But his most valuable service to geography was perhaps the compilation of the series of exhaustive bibliographies of the Barbary States—a work of great labour—published in the Supplementary Papers of our *Proceedings*. He had joined our Society so far back as 1860. Since his retirement in 1896 he had resided at St. Andrew's, for which he always expressed an enthusiastic preference to all other towns in Europe, occupying his leisure hours by writing down his varied reminiscences of life in Asia and Africa. Two instalments have appeared in *Chambers's Journal* for the current year, one of which tells—for the first time, it is said, correctly—the story of the British acquisition of Perim island.

Of Sir Lambert Playfair's private life and character we cannot here say much. It can only be remarked that his genial and kindly nature made him a general favourite, and that his loss will be widely regretted. He is survived by Lady Playfair, several sons, and a daughter.

William Frederick Webb.

William Frederick Webb, who died at Luxor in February last, was born in 1829. On leaving Eton he joined the 17th Lancers, but soon went to South Africa, where he became well known as a successful and daring sportsman at a time when big game was still plentiful on the plains outside the limits of the Colony, in regions that have now become mining centres, and from which the game has been necessarily expelled. It was while thus engaged that Webb first made the acquaintance of Dr. Livingstone, then a missionary among the Bechuana tribes, and thus was formed a friendship that continued without interruption to the last.

When Livingstone came back to England in 1864, from his second great expedition, his friend Webb, now the owner of Newstead Abbey, induced him to make that historic mansion his home. There, as the guest of Mr. and Mrs. Webb, he spent eight of the happiest months of his life, writing an account of his explorations, and planning his last journey, which resulted in the discovery of the headwaters of the Congo.

For thirty-seven years Mr. Webb had been a Fellow of this Society, and had devoted much of his time to travel. There were few parts of Asia, Africa, or America which he had not visited either for sport or amusement.

John M. Cook.

Mr. J. M. Cook, head of the world-famed firm of travelling agents of that name, died at his house at Walton-on-Thames on March 4. The deceased gentleman had been associated with the firm since its removal from Leicester to London in 1864, and took an important share, together with his father, the founder of the firm, in the building up of the business to its present proportions. He had been for nearly nineteen years a member of our Society, and may be said to have done much for the popularization of geography, by the greatly increased facilities for foreign travel which have resulted from his persevering efforts. The greatest achievement of the firm was, perhaps, the provision of the transport arrangements for the Nile Expedition of 1884–85, which was placed entirely in its hands by the British Government. The arrangements connected with the German Emperor's visit to Palestine were last year placed in Mr. Cook's hands, and an illness by which he was attacked in Jerusalem resulted in an undermining of his health, from which he never completely recovered.

CORRESPONDENCE.

The Source of the Oxus.

In a paper in the *Geographical Journal* for January, entitled "The Proceedings of the Pamir Boundary Commission," whose excellent published narrative it reviews, there occurs a passage which should not, I think, be allowed to pass altogether without comment. The writer is speaking of the recorded observations of the English members of that commission in the neighbourhood of Lake Chakmaktin, on the Little Pamir. This is the lake from the eastern end of which flows the Aksu or Murghab branch of the Oxus; while from the low plateau at its western extremity a pretty rivulet, fed from a neighbouring ravine, flows down and joins the Wakhan-daria, or main stream of the Oxus, below Bozai Gumbaz. It was once reported that Lake Chakmaktin had both an easterly and a westerly outflow, but all recent explorers, from the time of Gordon in 1874 onwards, while noticing the exit of the Aksu, have failed to observe any similar phenomenon at the western extremity of the lake. The members of the Boundary Commission, however, in August, 1895, found that a stream which they call the Chilab stream, and which is the easternmost source of the Little Pamir or Sarhad branch of the Oxus, already spoken of, was divided near the lake into two channels, one of which discharged eastward into the lake, while the other flowed westward down the valley towards Bozai Gumbaz. As this Chilab stream rises in the mountain range separating the drainage of the Little Pamir from that of the Great Pamir; as from the other side of this watershed spring the feeders of Lake Victoria; as, according to the above observations, the Chilab feeds both the Little Pamir branch of the Oxus and Lake Chakmaktin; and as the latter is the admitted source of the Aksu, the writer of your article arrives at this conclusion: "Surely, then, the true source of the Oxus lies amid these glaciers, for no single affluent can compete with these three combined."

I am afraid that this ingenious edifice of inference will hardly stand the test of examination. For that the Chilab stream, which the commissioners found to be connected by a channel with Lake Chakmaktin, is ordinarily so connected, is disproved by the observations of all previous travellers. I made a most careful examination of the marshy ground and the low plateau at the west end of the lake when I was there in September, 1894; and not only can I aver that there was no water either flowing into or out of the lake at its western extremity, but there was not a drop of water in the Burgutai gorge itself, down which the Chilab stream flows from what is now called the Nicholas range. That stream is the uppermost affluent of the Little Pamir or Sarhad branch (a very insignificant one) of the Oxus. It is frequently empty itself. It can only be at times of exceptional water, then, that any portion of its contents overflows to the east and makes its way into the lake. To base upon this transient and accidental occurrence the contention that in the glacier sources of the Chilab, which are also on the different side of the watershed from those of the Lake Victoria or Pamir river drainage, lie the head springs of the Oxus, seems to me, I confess, a very disproportionate deduction from wholly inadequate premises. A source of a river can hardly be that which is ordinarily and habitually dry. That Lake Chakmaktin, and not the Chilab stream from the Nicholas glaciers, is the parent of the Aksu I hold, therefore, to be incontestable. Moreover, that the true source of the Oxus lies in the glacier springs of the Wakh-jir, below the Wakh-jir pass, has never, I believe, been doubted by any one who has visited that spot, and was, I think, sufficiently demonstrated in a monograph, entitled "The Pamirs and the Source of the Oxus," which originally appeared in the pages of the *Geographical Journal* in 1896.

Curzon of Kedleston.

Calcutta, March 1, 1899.

The Proceedings of the Pamir Boundary Commission.[*]

It was just five and twenty years ago that I had the satisfaction of proving, by personal observations in the Pamirs, that the lake of the Little Pamir (or Chakmaktin, as it is now called) had, contrary to the general belief of geographers, only one outlet, and that eastward, and that its waters flowed into the Ak-sú, afterwards the Murghab, which joins the Oxus near Wamur, and is in all probability the longest branch of the Oxus.[†] The importance of this discovery in the then state of political geography was very considerable, on account of the disputed boundary between Russia and Afghanistan, in the neighbourhood of the upper waters of the Oxus.

I now learn, to my surprise, that the writer of the article on "The Proceedings of the Pamir Boundary Commission," which appeared in the *Geographical Journal* of January, 1899, attempts to gainsay this discovery.

He writes as follows: "Early explorers represented the lake as having two outlets—one eastward to the Aksu, and the other westward to the Ab-i-Punja. Later explorers maintained that the lake drained only to the eastward, and that it was the source of the Aksu-Murghab river only. Neither view is entirely correct, though the former perhaps more nearly approaches the truth than the latter."

This latter statement is absolutely contrary to the facts of the case, as I shall proceed to prove. The sole grounds on which it is based is that a stream coming from the so-called Nicholas range, divides into two portions close to the western shores of Lake Chakmaktin, one portion flowing *into* the lake and passing out again into the Aksu, and the other flowing westward into the Ab-i-Punja. This division of the drainage is said to occur in the marshy swamps which border the lake.

Now, admitting the fact thus stated, it clearly proves the contrary of what the writer deduces—one portion of the divided stream pours *into* the lake and out at the *eastern* outlet, the Aksu river; while the other portion flows into and, in fact, forms the extreme headwaters of the Ab-i-Punja, or Wakhan river; but not a drop of water flows *from* the lake into the Ab-i-Punja, although, from the somewhat distorted map accompanying the paper (in which each of the two branches into which the stream divides is made much larger than the parent stream), it would appear that there is a large flow of water from the lake into the river.

To those who are interested in the subject, I would recommend the perusal of p. 204 of the R.G.S. *Journal* of 1878, vol. xlviii. It will there be observed that, not completely satisfied with my laborious examination of the ground under circumstances of exceptional difficulty, I deputed the native officer of our escort (the Resseldar Mahommed Afzul Khan, who subsequently came to England in attendance on H.R.H. the Prince of Wales) to make a fuller examination later on in the year. In doing so, he rode completely round the bend of the west end of the lake up to the foot of the steep mountains rising on the south side. The snow was then all melted, and water was flowing *into* the lake from the two sources I had described in my paper, but there was no outlet westward. On proceeding to the east end of the lake, he found a large stream of water issuing from it eastward—the headwaters, in fact, of the Aksu river. Now, as regards the two streams flowing into the west end of the lake, one was derived from hot springs; the other (which I had described in my paper as a frozen stream, on which, going along westward, the barometer showed I was working uphill) is, I have no doubt, identical with that portion of the divided stream alluded to by the writer of the article in the *Journal* as flowing into the lake.

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[*] See *Geographical Journal*, January, 1899.

[†] *Vide* R.G.S., vol. 48 (1878), pp. 204 and 205.

I may mention that this division of a stream into two parts flowing in different directions is by no means *unique*. An exactly similar case occurs at the watershed east of the Victoria lake, notice of which will be found on p. 221, R.G.S. *Journal* of 1878, where I state, "A frozen stream here comes down from the north, divided into two portions by a low ridge of gravel, one flowing eastward into the Aksu river, the other westward into the lake.

Before laying down my pen, there are some other matters in the article under review in which I am personally interested, and on which I should like to enlarge.

Every explorer likes to discover something fresh, and, I fear, sometimes to pick holes in the work of his predecessors. Now, when a lake such as Chakmaktin, surrounded on all sides by lofty snow-covered mountains, is described as one of the principal sources of the Oxus, it is obvious that its principal supply of water must come from the melting of the snow and of such glaciers as may be lying in the recesses of the surrounding mountains—*ça va sans dire*—and it can hardly be considered as a new discovery, as seems now to be claimed, that the waters of the Oxus are derived from such a source.

I had a passage-of-arms at one of the R.G.S. meetings some years ago with the present Governor-General of India, who claims that he discovered the main sources of the Oxus in an altogether different locality, viz. the Hindu Kush mountain range. Although his lordship had much to say on behalf of his theory, I think it is still an open question as to whether that branch of the Oxus flowing from the Little Pamir lake—known afterwards as the Aksu, and later on its course as the Murhabi—is or is not the principal feeder of this interesting river.

The Murghabi river meets near Kila Wamur, in Roshan, that branch of the Oxus which, known as the Punjah or River of Wakhan, carries away the drainage, not only of the Hindu Kush, but of the Victoria lake region. This junction was visited in the spring of 1874 by the "Munshi," a native surveyor attached to the Forsyth Mission, and I quote from my report (p. 215, R.G.S., 1878): "The Munshi crossed the river (Murghabi) about 200 paces above its junction with the Punjah; the stream was in three channels, and the torrent was so rapid that most of the horses lost their footing. The Punjah stream was very clear, but the Murghab was red, thick, and muddy. The volume of the latter was considerably larger and its velocity greater than that of the Punjah. From bank to bank the width of the river-bed is about 1½ mile, and of this at least a mile was covered with water. The passage was effected with great difficulty. In the summer floods the water is said to extend from mountain to mountain, a distance of not less than 5 miles; it can then only be crossed by boats."

I am aware that this is not conclusive, and I believe Lord Curzon has the evidence of another reliable eye-witness that at a different period of the year the Punjah river was the greater of the two. I have been endeavouring lately, but I am sorry to say without success, to obtain from Russian sources the results of more recent observations.

It may be interesting to know that the "Munshi," who was a Mohammedan native of Kashmir, was subsequently employed by my former chief, the late General J. T. Walker, on further exploring operations in dangerous places in Central Asia. From the last of those he never returned, and he was long mourned for in India as a martyr to science, but some years later on, during the Afghan war, my old friend Sir Thomas Holdich came across him in Afghanistan commanding the Ameer's artillery!

In the article under review, I observe that my name is twice mentioned in connection with serious discrepancies, in heights and other elements, between the results of my work and those of the Pamir Boundary Commission. As I do not wish to go down to posterity as an inaccurate or careless observer, I feel it incumbent on me to make some observations on this subject.

Firstly, as regards the altitude of Victoria lake, which Wood, its original discoverer, made to be 15,600 feet above sea-level; my observations made it 13,950 feet, whereas the Pamir Commission estimate it as 13,390 feet. I willingly accept the correction as final, until a fresh generation of observers makes some further change. It appears that the height has been trigonometrically fixed from the Indian side, and that it is in agreement with the barometrical determinations of the Russians. The reviewer very fairly remarks that my observations were made in the unsettled spring weather, when single barometric determinations are of little value.

On the occasion of our excursion to the Pamirs, the only mercurial barometer that survived the journey across the Himalayas had to be left at our headquarters at Yarkand, and the instruments with which my observations were made were two aneroid barometers and a hypsometer. The former, even the best of them, are sadly unreliable and apt to change their index error; the hypsometer is a very unsatisfactory instrument to use in a gale of wind or in a blinding snowstorm. I will willingly admit corrections to any of my height determinations on the trip to Wakhan and back to Kashgaria, made by skilled observers with superior instruments and with more time than I had at command; but my height determinations of Yarkand and Kashgar are of a different class, being based on observations with mercurial barometers, extending over a long period of time, and carefully reduced to the base station at Leh, in Ladakh, where, during my absence from India, regular barometric observations were systematically taken under the direction of the late Mr. Shaw.

In my published report on the survey work of the Yarkand Mission were given some very carefully prepared diagrams, showing not only the curves of the mean barometrical diurnal variation at Yarkand and Leh, but also showing a comparison between the barometric waves at Kashgar, Yarkand, Leh, and Deira Doon (the headquarters of the Great Trigonometrical Survey of India) during the months of December, 1873, and January, February, March, 1874. These last showed very interesting and important results; the waves, as shown in the diagram, at Kashgar and Yarkand were almost identical—a result to be reasonably expected, from their similar position in the great plains of Kashgaria. The wave at Leh observatory, 11,538 feet above sea-level (distant as the crow flies about 300 miles south of Yarkand, and separated from it by several mountain ranges) showed a very remarkable series of elevations and depressions, corresponding in the main with those at Yarkand and Kashgar, but generally occurring two days after those at the last-named stations. Several of them were again to be traced, but not in so regular a manner, at Deira Doon, at the foot of the Himalayas, some 270 miles south of Leh, the periods of depression and elevation according fairly with those at Leh.

These observations would tend to show that, although the comparison of the mean barometrical readings for this period of four months would probably furnish very accurate data for the difference of height between Leh (which has been determined by trigonometrical methods) and Yarkand, yet that a calculation based on a single day's observation might give very erroneous results, amounting on one particular day (January 12) to a difference corresponding to six-tenths of an inch in the height of the mercurial column, an amount considerably exceeding the difference between my determination of the height of the Victoria lake with that of the Boundary Commission. As a matter of precaution, however, all heights on our Pamir expedition were calculated with Yarkand Observatory as a base station, at an estimated height of 3923 feet above sea-level. This would lessen the chance of error.

And now to another and still more interesting question, viz. the position and height of the highest mountain north of the Himalayas.

It will perhaps be recollected by those who have read my paper in the R.G.S. *Journal* of 1878, that I alluded to receiving, while at Yangi-hissar, a budget of English letters, and that on opening the last file of the *Times* I was astonished to find a letter from the Berlin correspondent of that journal, arguing that a railway might without the slightest difficulty be constructed from the Oxus basin to that of the Tarim in the approximate latitude of 39°, and that I glanced up from my paper as I read, and in the exact spot indicated I saw vast inaccessible (to me), apparently unbroken mountain masses covered with perpetual snow, and rising to a height of more than 20,000 feet.

Now, the *Times* correspondent was certainly somewhat behind the times, but even if he had been better informed he could only have known that there was a big mountain range lying west of the line Yarkand to Kashgar, unless, indeed, he had read Hayward's paper in the R.G.S. *Journal* (which I have not by me to refer to), where he would have learned that there was in this range a high mountain peak called Tagharma.

There appear to be doubts as to the accuracy of the position assigned by me to this Tagharma peak, whose height above sea-level I estimated to be 25,350 feet. The position given for it in my map can, of course, only be regarded as approximate, and must at once give way to any modern scientific survey conducted either by Russians or Englishmen; my only means of fixing its position was by bearings taken with a prismatic compass from Yangi-shahr (Kashgar) and Yapchan, positions some 13 miles apart from each other, and distant 80 and 73 miles respectively from the mountain in question. The relative positions of and distances between the ends of the base were also solely dependent on prismatic compass bearings taken surreptitiously by a native surveyor, who calculated the distance by the number of his paces. The position of the starting-point, Kashgar, is also a further element of uncertainty, depending entirely, both as to latitude and longitude, on my own astronomical observations at that place. Its latitude may be taken as absolutely correct.

After allowing for the different posts of observation, the difference between my astronomically determined longitude of Kashgar and that of the Russian Colonel Scharnhorst (in 1872) is somewhat less than 2 miles, the position assigned by me being that distance in excess, *i.e.* to the east of the Russian value.

Unfortunately, Kashgar and Yapchan were the only places from which I could get a view of the mountain. Owing to haze, it was never visible from any place that I visited further south. Had I been fortunate enough to have had a clear day at Yangi-hissar or elsewhere, its position could have been determined with much greater accuracy.

To any one familiar with the subject, it is evident that what with the rough measurement of the base, the instrument used, and the very acute angle of the triangle at Tagharma peak, the position fixed for the latter can only be considered as approximate, and must at once give way when put in comparison with the result of more scientific survey.

As regards the estimated height, my value is based on observations taken from the same two points with a small but very good 6-inch altazimuth instrument, and I confess I am surprised and disappointed that there is apparently so great a discrepancy between my results and those obtained by the Pamir Boundary

Commission, but it is as yet by no means certain that the Muztagh Ata to which observations were taken by them is the same mountain that was observed by me. When at Tashkurghan, on my way to the Pamirs, I got a view of the Muztagh Ata, and took bearings to it, but I was in so much doubt about its being my old friend the "Tagharma," that I decided later on not to make use of the observations I had taken at Tashkurghan.

I shall be indeed pleased when the Russians complete the survey of this part of the world, and set at rest the interesting and apparently still undecided question as to the height and geographical position of the highest peak of the Kizilyart range.

The reviewer states that the most northern of these high peaks is in lat. 38° 35', and believes this to be my Tagharma peak, to which I had myself assigned a position of 38° 35′ 15″ N. lat. and 75° 22′ 47″ E. in longitude; but I can state positively that there is another double-headed peak visible from Kashgar, situated about 23 miles north of the Tagharma, whose altitude I estimated at 22,500 feet.

On the other hand, the Russians have applied a height of 25,000 feet to another mountain further south, called the Muztagh Ata (the one presumably which I saw from Tashkurghan), which the Boundary Commission have now scientifically determined to be 23,480 feet high. I think it very probable that it will eventually turn out that the Muztagh Ata and the Tagharma peak are one and the same mountain, an opinion I once held, but subsequently discarded. This was also the opinion of Colonel Gordon (now General Sir T. Gordon), the chief of our mission to Wakhan; in fact, he never had any doubts on the matter, and in his 'Roof of the World' he gives a full-page picture of "The Muztagh (Tagharma peak) from Tashkurghan, Sirikol, looking north," and, further, in his letterpress says, "We had a glorious view from our camp in the Sirikol valley of the majestic Tagharma peak (known then as the Muztagh "mountain of ice") about 40 miles to the north, towering to a height of 25,000 feet, as estimated by Captain Trotter. It looked a perfect mass of snow and ice, and glistened with numerous glaciers."

I have not yet had an opportunity of seeing the Report of the Boundary Commission, but hope shortly to do so.

Before closing this letter, I should like to make a brief allusion to another question dealt with in the January number of the *Geographical Journal*. In the Monthly Record, in dealing with Mr. Cobbold's journey in Central Asia, it is stated, "From Kashgar he crossed the Tian Shan range by the Turgat (Tur Agat) and Tash Rabat passes and Lake Chatir Kul, to the Naryn valley, and finally to Lake Issyk Kul. In this section of his route, he was, we believe, on ground not previously visited by an Englishman, though known from the explorations of Russians and other travellers."

Now, it is a sad reflection to think that one should outlive the memory of one's deeds. Such is, I fear, my case; I cannot refrain, then, from bringing to notice that on p. 192 of the oft-quoted volume of 1878 will be found a description of my journey by the Turgat pass to Chadir Kul in January, 1874, in company with Colonel Gordon and Captain Biddulph. In Gordon's 'Roof of the World' will be found (p. 64) an admirable panoramic view of the Chadir-Kul lake in the Tian Shan plateau, "Russian Frontier: wild sheep in the foreground."

I have a very vivid recollection of this trip, for three special reasons—

1. It was, I think, the coldest journey I ever performed in my life.

2. The country traversed was the scene of the greatest humiliation and mortification that I ever experienced. All three members of our party were very keen sportsmen, and we were for the first time in the country of the *Ovis Polii*,

no specimen of which had, up till then, fallen a victim to an English sportsman. I was the first to spy a large flock, and I made a long and most successful stalk, my rival Colonel Gordon watching me all the time from the crest of a neighbouring ridge. I got within about 70 yards, fired, and missed! I recollect it as if it were yesterday. The weapon was one to which I had not been accustomed, with a very high trajectory. The sheep were out of sight before I could reload, and neither I nor any others of the party ever got another chance in that part of the country, although some months later on I partially retrieved my reputation while in the Pamirs by shooting from the road, while on a long and dreary march of 37 miles, the first specimen of this famous sheep ever killed by an Englishman.

3. My third reason is perhaps more worthy of the columns of your *Journal*, and with it I hope to conclude this rambling letter.

In these modern days it has more than once happened that British and Russian officers have met together in a friendly way to lay down disputed boundaries, and thus scientific and accurate geographical determinations of the position of various places in Central Asia have taken the place of former doubtful values; but this expedition to Chadir Kul made me the pioneer of the more scientific work that has followed. The survey-link connecting Kashgar and Chadir Kul was the first piece of work common to Russian and English geographers. The Russians, I believe in 1872, astronomically determined the position of the east end of Chadir Kul lake, and made a rough route survey of the above-mentioned link; they also in the same year took astronomical observations at Kashgar. In the following year I took astronomical observations at Kashgar, and made a route survey thence to Chadir Kul, and when I returned to India and worked out the results of my observations at Kashgar, and plotted in my route to Chadir Kul from my own determination of Kashgar, I found that, adopting the Russian value in latitude of the east end of the lake, our positions in longitude of the same point almost exactly coincided.

To appreciate the satisfaction I felt at this result, it must be recollected that at the time of which I write the wildest discrepancies existed in all maps, both Russian and English, as to the positions of large and important towns in Turkistan. One of the results of my work was to shift the position in longitude of Khotan 33 miles to the east of the position hitherto assigned to it both in English and Russian maps. I put it in 79° 59′ instead of 79° 26′. I may note that at about the same period Russian geographers shifted the cities of Aksu and Kurdja some 40 miles to the east of the positions hitherto assigned them.

By a curious coincidence, the *Geographical Journal* of January refers yet again to another matter connected with the survey work of the Forsyth Mission of 1873–74. I allude to the paragraph about Captain Deasy's travels in Central Asia (p. 65), where he is stated to have discovered the sources of the Khotan river in lat. 35° 35′ N. and long. 81° 40′ E.

Referring to the map which was prepared to accompany my paper in R.G.S. *Journal* of 1878, I find, in the projection of Kishin Sing's route-survey from Khotan to Leh *viâ* Polu, that in lat. 35° 3′ and long. 81° 30′ his route crosses a stream, the waters of which are shown by a dotted line to flow into the Khotan river. That stream evidently takes its rise in the mountain chain faintly shown on the map as lying to the immediate east of Kishin Sing's route, and it is probably in that range that Captain Deasy has come across the sources referred to. The position assigned by Captain Deasy to the sources of the Khotan river coincides almost exactly with the spot marked Aksu in the map, which is on the upper waters of the Kiria river, as shown by Kishin Sing.

I have always placed great confidence in the Pundit's work, for the reasons given on p. 223 of my paper referred to, especially in the correctness of his latitudes, and it will be seen, from the printed report on the Yarkand Mission Surveys (p. 21 of 'Abstract of Latitude Observations'), that sextant observations for latitude were taken at Arash, south-east of Aksu, on the nights of July 12 and 13, 1874, with very accordant results, making the latitude of that place 35° 29′ 54″, which may be taken as within a few seconds of the truth, and I think it by no means impossible that it will ultimately be shown that Captain Deasy mistook the head-waters of the Kiria for those of the Khotan river.

On the other hand, the Pundit's work showed that his route was crossed by a stream flowing into the Khotan Darya about 30 miles to the south of the position determined by Captain Deasy. I would rather hope, therefore, that, owing to discrepancies in longitude (which is far more likely than in latitude), it may turn out that both explorers were correct in their hydrography, in which case Captain Deasy's river will be found to run a southerly course for some 30 miles before flowing to the west.

I must apologize for the length to which this paper has extended; but when I took up my pen I found that my geographical zeal of a quarter of a century ago, although lying long dormant, is still strong in my system and required an outlet. I trust that the matter that has flowed through it will have convinced my readers of the correctness of my original views as regards the drainage of the Little Pamir lake.

HENRY TROTTER, Lieut.-Colonel.

Galatz, Rumania, February 20, 1899.

Hannibal's Pass.

There are two statements in Mr. Westlake's paper on this subject in the last *Journal* that I venture to correct, as they may mislead the weaker brethren.

1. He states that Varro informs us that Hannibal used the Col de l'Argentière, and Hasdrubal the Mont Cenis. Of course, in neither case does Varro *name* the passes by which these two generals crossed the Alps; if he had, much, much ink would have been saved. It is merely a theory that the passes mentioned by Varro can be so identified, or are given in topographical order. As to the Mont Cenis, I am, and always have been, quite incredulous. The earliest clear and distinct mention of this pass by name is in the eighth century A.D., while the valley of the Arc (or Maurienne) which leads up to it on the Savoy side seems to have been completely unknown to the Romans, and appears in authentic history only in the sixth century A.D. Of course, the Mont Cenis *may* have been used earlier, but we have absolutely no evidence of any kind that it was crossed before the eighth century A.D. I may add that I am perfectly acquainted with Mr. Freshfield's arguments to the contrary, which were published in the *Alpine Journal* when I was editor of that periodical, and seem to me quite inconclusive on this point. I also know the Mont Cenis very well.

2. Mr. Westlake contrasts "the rich plains between the foot of the Argentière and Turin" with the narrow valley of the Dora Riparia, descending from the Mont Genèvre. Now, I have often been over the Mont Genèvre, while in June, 1883, I was the companion of Mr. Freshfield on his passage of the Argentière. All I can say is that I never saw "rich plains at the foot of the Argentière" till the Stura issued from its narrow valley into the Piedmontese plain at Borgo San Dalmazzo, which is 8 miles from Cuneo, but 33 *miles* from Argentera, the village immediately at the foot of the pass. Perhaps I may be allowed to refer Mr. Westlake to my

descriptions of the routes over the two passes in the new edition (1898) of vol. i. of Mr. Ball's 'Alpine Guide.'

I have a fair working knowledge of the literature relating to Hannibal's pass, and have long ago come to the conclusion that the original extant accounts are quite contradictory, and that they cannot be reconciled. I have had, too, the advantage (probably never enjoyed by any other person) of having myself traversed every pass (with one or two exceptions), great or small, that has ever been claimed for Hannibal even by the wildest theorist, while in the case of these rare exceptions I have been on the summit of the pass, actually traversing but one side up and down, yet having had a close view of the other side. And I have no hesitation in stating that I am entirely and wholly in favour of the Mont Genèvre as most probably Hannibal's pass, the old mule-path from Clavières to Césanne (see Ball, vol. i. p. 80) being of course preferred to the circuitous modern carriage road. Most recent writers on the Continent are in favour of the Mont Genèvre, save, of course, Mommsen, who still clings to the impossible Little St. Bernard. The case for the Mont Genèvre has lately been very forcibly stated by Prof. Josef Fuchs in his small tractate entitled 'Hannibal's Alpenübergang' (Vienna, 1897), based on personal investigations on the spot, and with full knowledge of all the literature. As far as I am aware, Mr. Freshfield and Mr. Westlake stand alone in advocating the claims of the Argentière, which I for one consider quite baseless.

W. A. B. COOLIDGE.

March 7, 1899.

Lowthian Green's Tetrahedral Theory.

In the March number of the *Geographical Journal*, p. 250, I read the following words of Mr. Vaughan Cornish, speaking on the theory of Lowthian Green:—

"It is not the smallest part of our indebtedness to Dr. Gregory that his great power of exposition has brought this theory again before the world."

If Mr. Cornish would have spoken of the "*English* world," I would have nothing to object. But I am entitled to state that as early as 1881, the first edition of my 'Traité de Géologie' contained a detailed account of the Lowthian Green theory, together with a discussion of the Elie de Beaumont pentagonal system. Moreover, the diagrams 4*a* and 5*b* of Mr. Gregory are nearly identical with the drawings in my book.

As the expansion of my 'Traité' has been a very large one (more than 11,000 copies are now circulating through the world, and a fourth edition is in the press), I would claim for myself the merit of having, *eighteen years ago*, "brought before the world" the theory of the distinguished English writer, while Green's countrymen had failed to appreciate the work in due time.

PROF. A. de LAPPARENT.

Paris, March 3, 1899.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898–1899.

Sixth Ordinary Meeting, February 27, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS:—*Sidney J. Braithwaite; Captain Charles Ernest Carr; Colonel Arthur George Hay Church; James Creelman; Henry Nathaniel Gardiner, M.S.A.; Samuel Day Hopkinson; Walter, Lindley Jones; Charles Gerald Lee; Heber*

Mardon; Edward Octavius Potter; Charles Schaefer Rutledge; George Todd Symons; Louis Robert Stirke Tomalin; Captain A. E. Watherston, R.E.; John Mason Welsh, Ph.D.; Captain William Graham White, R.N.; Richard T. Williamson, M.D., M.R.C.P.; Ernest Henry Woolrych.

The PRESIDENT said: Before commencing the business of the evening, I have to announce to the Fellows that the Lord Mayor has invited you all to attend a meeting at the Mansion House on Monday, March 6, at 3 p.m., when there is going to be a discussion on the best way of celebrating the thousandth anniversary of the death of Alfred the Great. King Alfred was one of our first geographers, and one of our greatest, and was the first to begin to collect accounts of voyages and travels, and to give to Englishmen an idea of what geography is, and the uses it can be put to. I think this movement for celebrating the greatness of King Alfred should receive the support of all the Fellows of this Society. I must also refer to the great meeting that was held a fortnight ago at Berlin on the subject of a German Antarctic expedition; it was an enthusiastic meeting. The Emperor intended to have been present, but, being unable to come, he sent a letter in which he expressed regret at not being present. It was announced that most liberal and generous support had been given to the German antarctic expedition by wealthy and patriotic men of that country. It was announced, also, that the Government had come forward with a large vote in order to supplement the generosity of private individuals. It was also announced that the Germans hoped and expected that we would join with them and co-operate in the work of exploring the antarctic regions, and they went so far as to sketch out a scheme with that object. I have only to say that there is a great contrast between what patriotic men are doing in that country and what we are doing here, and I trust most sincerely that the contrast will not be allowed to continue.

I have further, with much regret, to allude to the death of Sir George Bowen. I will not refer, it is not my place to refer, to his public services; but we lament the loss of a useful member of our Council, and a most entertaining, genial, and kindly friend. We have also lost within a very few days Sir Lambert Playfair, who has done so much for geography in his 'History of Yemen,' and his valuable and interesting works on the Barbary States, and so much for the Society by his labours on the bibliography of Algeria and the Barbary States.

The Paper read was:—

"Travels and Researches in Rhodesia." By Dr. H. Schlichter.

Seventh Ordinary Meeting, March 13, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Thomas Augustine Bland; Reginald Thomas Hacker Bodilly, L.R.C.P., M.R.C.S.; Lieut. Richard George Tyndall Bright (Rifle Brigade); Captain George William Freeman; George Herbert Graham; John White Hopkins, L.R.C.P., M.R.C.S.; G. J. Jacobs, F.R.A.S.; Sydney Edward Hamilton Lane; T. Lambert Mears; Lieut. Hugh I. Nicholl (Bedfordshire Regiment); Rev. William Albert Noyle; Frank Baldwyn Parkinson; Alfred Leonard Poile; Lieut. Francis Garden Poole (1st East Yorkshire Regiment); Frank Smitherman; Samuel Clement Southam, F.S.A.; Charles M. Taylor; George Weller, M.R.C.S.*

The Paper read was:—

"The Uses of Practical Geography, as illustrated in Recent Frontier Operations." By Colonel Sir T. H. Holdich, K.C.I.E., C.B., R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *C. Rd.* **128** (1899): 57–59. **Kilian and Lugeon.**

Une coupe transversale des Alpes briançonnaises, de la Gyronde à la frontière italienne. Note de MM. Kilian et Lugeon. *With Diagram.*

Austria—Bosnia. *B.S.R. Belge G.* **22** (1898): 467–491. **Hontoir.**

Par les routes nouvelles à l'ouest de la Bosnie. Par E. Hontoir.

Belgium. *Mouvement G.* **15** (1898): 614–615. **Martel.**

Exploration de la grotte de Han. Par E. A. Martel.

Denmark—Surveys. **Zachariae.**

Oversigt K. Danske Vidensk. S. Forhandl. (1898): 163–207.

Præcisionsnivellementet over Store Belt. Af Generalmajor G. Zachariae. Avec résumé en français.

On the survey operations across the Great Belt.

France—Geology. **Meunier.**

Stanislas Meunier. Nos Terrains. Paris: A. Colin & Cie., 1898. Size 12½ × 9, pp. xx. and 192. *Coloured Plates, etc.*

A popular account of the geology of France, with elementary instructions in practical geology, and many interesting coloured views of scenery.

France—Mont Blanc. *Atti R.A. Lincei, Rendiconti* **8** (1899): 34–38, 65–68. **Pizzetti.**

La gravità sul Monte Bianco. Nota di P. Pizzetti.

France—Morvan. *Ann. G.* **7** (1898): 404–428; **8** (1899): 6–21. **Michael-Lévy.**

Le Morvan et ses attaches avec le Massif Central. Par M. A. Michael-Lévy. *With Map and Sections.*

An analytic study of the physical geography of the highlands of Morvan, showing the relation of geological structure to geographical form.

France—Soil. *C. Rd.* **127** (1898): 1041–1043. **Meunier.**

Sur le rôle de la sédimentation souterraine dans la constitution du sol d'une partie du département de l'Orne. Note de M. Stanislas Meunier.

Germany. *G.Z.* **4** (1898): 601–617, 665–694. **Kurs.**

Die Künstlichen Wasserstrassen im Deutschen Reiche. Von Victor Kurs.

Germany—Alsace. *Deutsche G. Blätter* **21** (1898): 119–151. **Pilz.**

Die Wälder des Elsass in forstwirtschaftlichen. Beleuchtung. Von kaiserl. Oberforstmeister Pilz. *With Map.*

Germany—Thuringia. *M.G. Ges. Jena* 17 (1898): 71–94. **Gerbing.**
Die Strassenzüge von Südwest-Thüringen. Von Luise Gerbing. *With Map.*

An account of the old roads of Thuringia between Mühlhausen in the north, Mihla and Eisenach in the west, and Erfurt and Arnstadt in the east. The map on the scale of 1 : 130,000 distinguishes between ancient and modern roads.

Hungary. *M.G. Ges. Wien* 41 (1898): 535–592. ———
Die landwirtschaftliche Production der Länder der ungarischen Krone in den Jahren 1895 und 1896.

Italy. *Riv. G. Italiana* 5 (1898): 481–485. **Mori.**
Formazione di un nuovo laghetto presso la Falterona. Notizia di Attilio Mori.

On the formation of a new lakelet near Falterona.

Italy—Vesuvius. **Lapparent.**
Annuaire Club Alpin Français 24 (1897) (1898): 509–523.
Le Vésuve et la Somma. Par M. A. de Lapparent. *With Map.*
Also separate copy. *Presented by the Author.*

Mediterranean—Crete. ———
Turkey. Nos. 5, 6, and 7 (1898). Further Correspondence respecting the Affairs of Crete. [3 Reports.] London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. (No. 5) xii. and 206; (No. 6) vi. and 82; (No. 7) xii. and 142. *Price* (No. 5) 1*s.* 9*d.*; (No. 6) 9*d.*; (No. 7) 1*s.* 3*d.*

Norway. *Annuaire Club Alpin Français* 24, 1897 (1898): 412–471. **Ronjat.**
Promenades en Norvège. Par M. Jules Ronjat. *With Illustrations.*

Norway—Meteorology. **Mohn.**
Jahrbuch des Norwegischen Meteorologischen Instituts für 1896 (pp. xii. and 120); 1897 (pp. xii. and 120). Christiania, 1897–98. Size 13½ × 10½. *Presented by the Norwegian Meteorological Institute.*

Rumania. **Gubernatis.**
Comte Angelo de Gubernatis. La Roumanie et les Roumains. Impressions de Voyage et Etudes. Florence: B. Seeber, 1898. Size 9½ × 6½, pp. 308. *Illustrations. Price* 5 *fr.*

Russia. *J.R. United Service I.* 42 (1898): 1414–1423. **Beresford.**
The State Defences of Russia. Compiled by Lieut.-Colonel C. E. de la Poer Beresford.

Scandinavia. *Annuaire Club Alpin Français* 24, 1897 (1898): 524–589. **Vélain.**
Les pays Scandinaves et Finlandais. Par M. Ch. Vélain. *With Illustrations.*

Spain. *B.S.G. Madrid* 40 (1898): 122–129. **Blázquez.**
Vias romanas españolas. Por D. Antonio Blázquez.

On the Roman roads in Spain.

Spain—Pyrenees. *Annuaire Club Alpin Français* 24 (1897) (1898): 332–359. **Brousse.**
L'Enclave espagnole de Llivia. Par M. E. Brousse Fils. *With Map and Illustrations.*

On a little patch of Spanish territory in the French department of Pyrenées Orientales.

Sweden. *Ymer* 18 (1898): 221–232. **Nerman.**
Om Vätterns hydrografi. Af Gustaf Nerman.

On the hydrographic conditions of Lake Vetter.

United Kingdom—London. *J.S. Arts* 47 (1898): 7–21. **Barry.**
Opening Address. By Sir John Wolfe Barry, K.C.B., F.R.S. *With Plan.*

The address deals with the problem of accommodating the increasing traffic of the streets of London, and the plan suggested is the construction of new thoroughfares connecting the great traffic centres.

ASIA.

Asia. **Das.**
A Note on the Ancient Geography of Asia, compiled from Valmiki-Ramayana. By Nobin Chandra Das, M.A. Published by the Buddhist Text Society of India. 1896. Size 10 × 6½, pp. viii. and 78. *Map. Presented by the Author.*

A study of the early geography of India from the Himalaya to Ceylon, derived from the journeys of Rama recorded in the famous Sanskrit poem Valmiki-Ramayana.

Asiatic Travel. **Reid.**

From Peking to Petersburg. By Arnot Reid. London: Edward Arnold, 1899. Size 8½ × 5½, pp. vi. and 300. *Map and Portrait. Price 7s. 6d. Presented by the Publisher.*

Mr. Reid travelled in 1898 from Peking, through Mongolia, to Siberia, reaching the temporary terminus of the Trans-Siberian railway at Irkutsk, and proceeding thence by rail. The whole journey occupied fifty days, and was effected with comfort and without any dangerous adventures. Part of the book has already appeared in the form of articles in the *Times* and other newspapers.

Ceylon. **Leclercq.**

Un missionnaire belge dans l'île de Ceylan. Par Jules Leclercq. Extrait de la *Revue Générale*, février, 1899. Bruxelles: Société Belge de Librarie, 1899. Size 10 × 6½, pp. 16. *Presented by the Author.*

China. *Petermanns M.* **45** (1899): 8–13. **Cholnoky.**

Vorläufiger Bericht über meine Forschungsreise in China. Von Eugen v. Cholnoky.

This is referred to in a note on p. 430.

China. *Ann. G.* **8** (1899): 62–73. **Raveneau.**

La Chine économique, d'après les travaux de la mission lyonnaise, 1895–1897. Par M. L. Raveneau. *With Map. Also a separate copy presented by the Author.*

A summary of the great Report of the commercial mission of the Lyons Chamber of Commerce.

China. *Globus* **74** (1898): 349–350. **Schlüter.**

Die Reformbestrebungen in China und die Reaktion. Von Dr. O. Schlüter.

China. *Verh. Ges. Erdk. Berlin* **25** (1898): 410–430. **Schumacher.**

Herr Dr. Hermann Schumacher: Der Westfluss (Hsikiang) und seine wirtschaftliche Bedeutung.

China. *J.S. Arts* **47** (1898): 77–84. **Little.**

The Yangtse Basin and the British Sphere. By Archibald Little.

China—Peking. **Favier.**

Péking, histoire et description. Par Alph. Favier. Péking: Imp. des Lazaristes au Pé-t'ang, 1897. Size 13½ × 10½, pp. xii. and 562. *Illustrations. Price* £2 18*s.* 6*d.*

Finely illustrated with over 800 engravings, most of them reproductions of the work of Chinese artists.

China—Shantung. *Verh. Ges. Erdk. Berlin* **25** (1898): 379–410. **Gaedertz.**

Herr Ober-Ingenieur Gaedertz: Reisen in Schantung. *With Map.*

China—Yangtse Valley. **Foster.**

In the Valley of the Yangtse. By Mrs. Arnold Foster. London: London Missionary Society, 1899. Size 8½ × 7, pp. xii. and 216. *Illustrations. Presented by the Publishers.*

A book by a lady missionary, intended mainly for children.

China and Japan. *B.S.R.G. d'Anvers* **22** (1898): 143–155. **Reclus.**

L'Extrême-Olient. Par M. Elisée Reclus. *With Map.*

On the political geography of the Far East and its possible changes.

Chinese Empire—Tibet. *J. Asiatic S. Bengal* **67** (Pt. i.) (1898): 256–273. **Das.**

An account of Travels on the Shores of Lake Yamdo-Croft. By Sarat Chandra Das.

After recalling earlier visits to Lake Palti, and giving a short general account of Tibet, the author describes his journey to Samding, the great Buddhist monastery on the shore of Lake Yamdo in 1882.

Chinese Turkestan. *C. Rd.* **128** (1899): 154–156. **Tillo.**

Résultats des observations météorologiques faites dans la dépression au centre du continent asiatique (station Luktshoun).

Observations at Lukchun, in the middle of the Turfan depression, which are summarized on p. 431.

French Indo-China—Laos. **Bobo.**

Rev. Française **23** (1898): 505–516, 571–582, 725–733.

Les habitants du Laos. Par le Capitaine Bobo.

This paper deals with the mode of life of the people, their industries, and the resources of their country.

Hong Kong. ———
Treaty Series. No. 16, 1898. Convention between the United Kingdom and China, respecting an extension of Hong Kong Territory. Signed at Peking, June 9, 1898. London: Eyre & Spottiswoode, 1898. Size 10 × 6½, pp. 2. *Map. Price* 3½*d.*

India. **Gehring.**
Süd-Indien. Land und Volk der Tamulen. Von Hans Gehring. Gütersloh: C. Bertelsmann, 1899. Size 10½ × 7, pp. viii. and 246. *Map and Illustrations. Price* 5*s.*

India—People. *Ymer* **18** (1898): 203–219. **Johansson.**
Det moderna kastväsendet i Indien. Af K. F. Johansson.

On the caste system in modern India.

India—Tide-Tables. **Burrard and Roberts.**
Tide-Tables for the Indian Ports for the year 1899 (also January, 1900). Part i. —Western Ports (Suez to Pámban Pass). Part ii.—Eastern and Burma Ports (Galle to Port Blair). By Major S. G. Burrard and E. Roberts. Size 6½ × 4½, pp. 1172.

Indian Ocean—Seychelles. **Stewart.**
Seychelles. Annual Report for 1897.—Colonial Reports, Annual No. 252, 1898. Size 10 × 6½, pp. 12. *Price* 1*d.*

Indo-China—History. *Rev. G.* **43** (1898): 412–426. **Faure.**
Les origines de l'Empire français dans l'Indo-Chine. Par M. A. Faure.

This is the concluding part of a memoir commenced in 1888, describing the work of Poivre in the exploration of Indo-China for the French East India Company in the first half of the eighteenth century.

Kiauchou. *Kolonial Jahrb.* **11** (1898): 33–90, 148–155. ———
Kiautschou.

A history of the acquisition of Kiauchou, and an estimate of its value to Germany.

Malay Archipelago—Celebes **Kruijt.**
M.G. Ges. Jena **16** (1898): 1–48; **17** (1898): 21–66.
Beiträge zur Volkskunde der Poso-Alfuren. Von Missionar A. C. Kruijt.

A description of the Poso-Alfurian people, their industries, games, beliefs, and customs.

Malay Archipelago—Java. **Gallois.**
Annuaire Club Alpin Français **24**, 1897 (1898): 472–506.
Les Volcans de Java. Par M. Eugène Gallois. *With Maps and Illustration.*

Malay Archipelago—Philippines. *M.G. Ges. Wien* **41** (1898): 593–606. **Blumentritt.**
Der Batan-Archipel und die Babuyanen-Inseln. Von Ferdinand Blumentritt.

Malay Archipelago—Sumatra. *National G. Mag.* **9** (1898): 449–464. **Fairchild.**
Sumatra's West Coast. By David G. Fairchild. *With Illustrations.*

Russia—Caucasus. *Petermanns M.* **44** (1898): 251–258, 271–275. **Busch.**
Vorläufiger Bericht über eine Reise in den nordwestlichen Kaukasus im Jahre 1896 zur Untersuchung der Gletscher und der Vegetation. Von N. A. Busch.

Russia—Caucasus. *Annuaire Club Alpin Français* **24**, 1897 (1898): 690–697. **Regaud.**
Au col Dongouz-Oroum (épisode d'un voyage dans le Caucase). Par M. Claudius Regaud.

Russian Central Asia. *Norske G. Selsk. Aarb.* **9** (1898): 56–152. **Wille.**
Fra St. Petersburg til Turkestan af professor dr. N. Wille.

A journey to Askhabad.

AFRICA.

Abyssinia. **Orleans.**
Prince Henri d'Orléans. Une Visite à l'Empereur Ménélick. Notes et Impressions de route. Paris: Libraire Dentu. [*Not dated.*] Size 8 × 5½, pp. 264. *Illustrations. Price* 10 *fr.*

Abyssinia—Historical. **D'Abbadie and Paulitschke.**
Futûh el-Hábacha. Des conquêtes faites en Abyssinie au XVI^e siècle par l'Imam Muhammad Ahmad dit Gragne. Version Française de la Chronique Arabe du

Chabâb ad-Dîn Ahmad. Publication commencée par Antoine D'Abbadie, terminée par le Dr. Philippe Paulitschke. Paris: E. Bouillon, 1898. Size 9 × 6, pp. xxviii. and 394. *Price* 20 *fr.*

Africa—Colonization. **Johnston.**

A History of the Colonization of Africa by Alien Races. By Sir Harry H. Johnston, K.C.B. Cambridge: the University Press, 1899. Size 8 × 5½, pp. xii. and 320. *Maps. Price* 6*s. Presented by the Cambridge University Press.*

African Anthropology. *J. Anthrop. I.* **1** (1898): 55–94. **Shrubsall.**

A Study of A-Bantu Skulls and Crania. By F. Shrubsall, B.A. *With Plate.*

African Railways. *Contemporary Rev.* **75** (1899): 161–168. **Wills.**

"The Cape to Cairo." The Buluwayo-Tanganyika and other Railways. By J. T. Wills. *With Map.*

African Treaties. **Ortroy.**

Conventions internationales définissant les Limites actuelles des Possessions, Protectorats et Sphères d'influence en Afrique, publiées d'après les textes authentiques par le Capitaine Commandant F. Van Ortroy. Bruxelles, Soc. Belge de Librairie. Paris: F. Alcan, 1898. Size 10 × 7, pp. xx. and 518. *Map. Presented by the Publishers.*

This is a valuable collection of African boundary treaties and conventions given in the original languages, and rendered available for references by a series of very convenient indexes. These include a full chronological index extending from 1841 to 1896, a summary of documents arranged under the head of the countries concerned in alphabetical order, an index of the ministers, ambassadors, or agents signing the various documents, and a very detailed subject index mentioning all the place-names referred to.

Barongo Songs. **Junod.**

Les Chants et les Contes des Ba-Ronga de la Baie de Delagoa, recueillis et transcrits. Par Henri A. Junod. Lausanne: G. Bridel & Cie., 1897. Size 7½ × 5, pp. 328. *Illustrations. Price* 4 *fr. Presented by Poultney Bigelow, Esq.*

An interesting collection of the songs and folk-tales of the natives of the Delagoa bay district.

British Colonization. *Deutsche Rundschau G.* **21** (1899): 155–160. **Rumpe.**

Die Entwickelung des englischen Colonial-Besitzes in Afrika. Von Dr. Robert Rumpe. *With Map.*

British East Africa—Uganda. *B.S.G. Lyon* **15** (1899): 333–338. **Streicher.**

L'Ouganda. Par Mgr. Streicher.

Egyptian Sudan. *Rev. G.* **43** (1898): 401–411. **Rouire.**

Omdurman et Fachoda, le Soudan égyptien, rivalité de la France et de l'Angleterre sur le haut Nil. Par le Dr. Rouire.

French Congo. *Rev. Française* **23** (1898): 653–660. **Montell.**

La marche de la mission Marchand. Par A. Montell.

Describes, with dates, the march of Major Marchand across the Sudan.

French Sudan. *Rev. Française* **23** (1898): 689–704. **Montell.**

Au lac Tchad: Mission Gentil. Par A. Montell. *With Map and Portrait.*

South African Republic. **Evans.**

Report on the Trade, Commerce, and Gold-Mining Industry of the South African Republic for the Year 1897. London: Eyre & Spottiswoode, 1898. Size 10 × 6½, pp. 62. *Price 3d.*

Transvaal. *Norske G. Selsk. Aarb.* **9** (1898): 1–11. **Dahl.**

Erindringer fra et 2-aarigt ophold i Sydafrika af premierløitnant Johannes Dahl.

Observations during a two-years' stay in the Transvaal.

West Africa. *Petermanns M.* **44** (1898): 193–204, 265–271. **Frobenius.**

Der westafrikanische Kulturkreis. Von Leo Frobenius. *With Maps.*

West Africa—Niger boundaries. *Rev. Française* **23** (1898): 672–676. ——

Convention Franco-Anglaise du Niger. *With Map.*

West Africa—Niger countries. **Hourst.**

French Enterprise in Africa. The Personal Narrative of Lieut. Hourst of his Exploration of the Niger. Translated by Mrs. Arthur Bell (N. D'Anvers).

London: Chapman & Hall, 1898. Size 9 × 6, pp. xvi. and 520. *Map, Portrait, and Illustrations. Price* 24s.

The original French edition of this work was noticed in the *Journal*, vol. xii. p. 305.

NORTH AMERICA.

America—Aborigines. **Payne.**

History of the New World called America. By Edward John Payne. Vol. ii. Oxford: the Clarendon Press, 1899. Size 9 × 6, pp. xxviii. and 548. *Price* 14*s*. *Presented by the Clarendon Press.*

This volume continues the scholarly study of the American aborigines commenced in the previous part of the work, discussing the degree of civilization attained, the character of the languages, the spread of the primitive people over America, and the history of the Mexican and Inca empires.

American Geology—Bibliography. **Weeks.**

Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the year 1896. By F. B. Weeks.—Bulletin of the United States Geological Survey, No. 149. Washington: 1897. Size 9½ × 6, pp. 152. *Presented by the U.S. Geological Survey.*

American Languages. **Brinton.**

A Record of Study in Aboriginal American Languages. By Daniel G. Brinton, M.D., etc., Media, Pa. Printed for private distribution, 1898. Size 10 × 6½, pp. 24. *Presented by the Author.*

Canada. **Penck.**

Reisebeobachtungen aus Canada. Vortrag gehalten den 16. März 1898. Von Albrecht Penck.—Vorträge des Vereines zur Verbreitung naturwissenschaftlicher Kenntnisse Wien. XXXVIII. Jahrgang, Heft 11. Wien, 1898. Size 7½ × 5, pp. 54. *Illustrations. Presented by the Author.*

An account of the geological excursion across Canada on the occasion of the Toronto meeting of the British Association.

Canada—Anticosti. *A travers le Monde, Tour du Monde* **4** (1898): 397–398. ———

Anticosti. *With Map.*

Canada—British Columbia. *Globus* **74** (1898): 358–362. **Dorsey.**

Bootfahrten zwischen Haida- und Tlingit-Dörfern, in der Nähe von Dixons Entrance. Von George A. Dorsey. *With Illustrations.*

Canada—British Columbia. *B.S.G. Italiana* **12** (1899): 26–32. **Simone.**

Attraverso alla Colombia Inglese. Relazione preliminare di viaggio del dott. D. R. de Simone. *With Map.*

Notes of a journey from Ashcroft up the valleys of the Frazer, North Tatlan, and Finlay rivers, and thence by the Dease river and across the Cassiar mountains to Lake Teslin, returning down the Stikine river to Fort Wrangell.

Canada—Mackenzie. *B.S.G. Paris* **19** (1898): 291–307. **Sainville.**

Voyage à l'embouchure de la rivière Mackenzie (1889–1894). Par Édouard de Sainville. *With Map.*

Canada—Montreal. ———

Montreal and the St. Lawrence Route.—The *Herald*, Montreal, November 26, 1898. Size 23 × 17½, pp. 24. *Illustrations.*

A special number of a Montreal newspaper setting forth the commercial advantages of that city and of the St. Lawrence route.

Canada—Tides. ———

Tide Tables for Halifax, Quebec, and St. John, N.B., for the year 1899; with Tidal Differences for the Atlantic Coast of Nova Scotia, and for the St. Lawrence River, from Three Rivers to Gaspé. Reprinted from Greenwood's Nautical Almanac and Tide Tables for 1899. Size 8½ × 7, pp. (8).

Canada—Yukon Territory. **Auzias-Turenne.**

Raymond Auzias-Turenne. Voyage au Pays des Mines d'Or—le Klondike. Paris: C. Lévy, 1899. Size 7½ × 5, pp. 318. *Maps and Illustrations. Price* 4 *fr.*

A graphic account of a journey to Klondyke in 1898.

Mexico. **Dominguez.**

Disertación hidrográfica. Por el Sr. Angel M. Dominguez.—Numero Especial del Boletin de la Sociedad de Geografia y Estatadística de la República Mexicana. Pp. 53–61. Mexico, 1898.

Mexico. *B.S.G. y Estad. Rep. Mexicana* 4 (1898): 50–72. **Howarth and Turnbull.**

El Popocatepetl y los Volcanes de Mexico. Estudio presentado á la Real Sociedad de Geografia de Londres en su sesión de 13 de Avril de 1896. Por Mr. O. H. Howarth, traducido y anotado por el socio Ingeniero Enrique A. Turnbull. *With Illustrations.*

Mexico—Oaxaca. *B.S.G. y Estad. Rep. Mexicana* 4 (1898): 93–130. **Noriega.**

La Geografia del Estado de Oaxaca. Por el Sr. Eduardo Noriega. *With Maps.*

Describes the physical geography of the state of Oaxaca, and the political subdivisions in some detail.

Mexico—Palenque. *Globus* 75 (1899): 77–80. **Förstemann.**

Aus dem Inschriftentempel von Palenque. Von E. Förstemann. *With Illustrations.*

On the decipherment of some of the old Mexican inscriptions.

Mexico—Palenque. **Maudslay.**

Biologia Centrali-Americana; or Contributions to the Knowledge of the Fauna and Flora of Mexico and Central-America. Edited by F. Ducane Godman. Archæology. By A. P. Maudslay. [Part x., January, 1899.] (Vol. iv. pp. 31–38.) London: R. H. Porter, and Dulau & Co. Size 13 × 10½. *Plates*, lxxiv.–xciii. *separate.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Märtens.**

Süd-Amerika unter besonderer Berücksichtigung Argentiniens. Nach den neuesten amtlichen Quellen und auf Grund eigener Anschauung. Von Dr. P. Märtens. Berlin: J. Räde, 1899. Size 8 × 6, pp. viii. and 284. *Map and Illustrations. Price* 4*s.*

Brazil. ——

Commissão Geographica e Geologica de São Paulo. Secção Meteorologica. Dados climatologicos do anno de 1893 (pp. 76); 1894 (pp. 88, *diagrams*); 1895 (pp. 84, *diagrams*); 1896 (pp. 84, *diagrams*); 1897 (pp. 68, *diagrams*). S. Paulo, 1895–96. Size 9 × 6½.

Brazil. ——

B. Commis. G. e Geolog. São Paulo 12 (1897): 1-496; 13, 1-221; 14, 1-128.

Flora paulista. I. Familia Compositæ. II. Familias Solanaceæ e Scrophulariaceæ. III. Familias Campanulaceæ, Cucurbitaceæ e Calyceraceæ. Serie Aggregatæ, Familia Valerianaceæ.

On the plants of São Paulo.

Brazil. **Coudreau.**

Henri Coudreau. Voyage au Xingú, 30 mai 1896—26 octobre 1896. Paris: A. Lahure, 1897. Size 11½ × 9, pp. 230. *Map and Illustrations.*

The account of the journey is supplemented by extensive vocabularies.

Brazil—Natives. *Globus* 75 (1899): 5–9. **Steinen.**

Indianerskizzen von Hercules Florence. Von Karl von den Steinen. I. *With Illustrations.*

Drawings of the wild Indians of Brazil, drawn by the artist Hercules Florence, who was born in Nice in 1804, emigrated in early life to Brazil, and died there in 1879.

Brazil—São Paulo. *B. Commis. G. e Geolog. São Paulo* 10 (1895): 1–116. **Löfgren.**

Ensaio para uma synonimia dos nomes populares das plantas indigenas do Estado de S. Paulo. Por Alberto Löfgren.

Chile. ——

Anuario hidrográfico de la Marina de Chile. Año 21. Santiago de Chile, 1898. Size 10 × 7, pp. xxx. and 560. *Charts and Diagrams.*

Dutch Guiana. **Benjamins.**

Tijds. K. Ned. Aard. Genoots. Amsterdam 15 (1898): 797–846.

De Grenzen van Nederlansch Guiana. Door Dr. H. D. Benjamins. *With Maps.*

A discussion of the boundaries of Dutch Guiana, taking account of the very curious character of the Dutch jurisdiction over the river Corentyne, which forms the boundary with British Guiana.

Ecuador—Galapagos Islands. **Ridgway.**

Birds of the Galapagos Archipelago. By Robert Ridgway.—Proceedings of the United States National Museum. Vol. xix. Washington, 1897. Size 9½ × 6, pp. 459–670. *Charts and Plates.*

An account of the avifauna of the Galapagos islands, taking account of all that is known on the subject, with references to previous writers.

French Guiana. **Hess.**

Jean Hess. A l'Ile du Diable. Enquête d'un reporter aux Iles du Salut et à Cayenne. Paris: Nilsson [not dated]. Size 7½ × 5, pp. 252. *Illustrations. Price 2s. 8d.*

Haiti. *Atti R. A. Lincei, Rendiconti* 7 (2 Sem.) (1898): 316–318. **Agamennone.**

Il terremoto nell' isola di Haïta (Antille) del 29 dicembre 1897. Nota del dott. G. Agamennone.

Honduras. *B.S.R.G. d'Anvers* **22** (1899): 181–219. **Jalhay.**

La République de Honduras. Par M. H. Jalhay.

An account of the geography, resources, and present condition of Honduras, by the Consul for that republic at Brussels.

South America. **Cisneros and Garcia.**

Geografia comercial de la América del Sur. Por Carlos B. Cisneros y Romulo E. Garcia. Parte Preliminar. Lima, 1897. Size 9½ × 6½, pp. x. and 6. *Presented by the Geographical Society of Lima.*

South American Indians. **Nery.**

Les Indiens et le peuplement de l'Amérique chaude. Par le Baron F. De Santa-Anna Nery.—Journal de la Société des Américanistes de Paris. Paris, 1898. Size 11½ × 9, pp. 20. *Presented by the Author.*

Baron de Santa Anna Nery points out that the interest of geographers and students has in recent years been largely diverted from South America to Africa. He treats of the native "Indians," and cites a number of instances of their natural qualities winning for them high reputation in competition with Europeans.

AUSTRALASIA AND PACIFIC ISLANDS.

British New Guinea. **Macgregor.**

Despatch from His Excellency the Lieutenant-Governor of British New Guinea, reporting visit inland to the Western end of the Owen Stanley Range, and thence across the Island to the North-East Coast. [No. 5.] 1898. Size 13½ × 8½. *Presented by the Colonial Office.*

Ellice Islands. *Natural Science* **14** (1899): 17–37. **Sollas.**

Funafuti: the Study of a Coral Atoll. By Prof. W. J. Sollas, M.A., etc. *With Illustrations.*

The Friday evening lecture given at the Bristol meeting of the British Association.

Fiji. ——

Fiji. Annual Report for 1897.—Colonial Reports, Annual No. 244, 1898. Size 10 × 6½, pp. 14. *Price* 1*d.*

Murray Islands. *J. Anthrop. I.* 1 (1898): 5–19. **Hunt.**

Ethnographical Notes on the Murray Islands. Torres Straits. By Rev. Archibald E. Hunt.

New Guinea. *Tijds. Indische Taal-, Land- en Volkenk.* **40** (1898): 287–316. **Serrurier.**

Die Korwäre oder Ahnenbilder Neu-Guinea's; ein Beitrag zur Geschichte der bildenden Kunst. Von Dr. L. Serrurier. *With Map and Plates.*

On the carved wooden ancestral images of the tribes of Dutch New Guinea, classified according to regions.

New Zealand—Year-Book. **Dadelszen.**

The New Zealand Official Year-Book, 1898. By E. J. von Dadelszen. Wellington, 1898. Size 8½ × 5½, pp. vi. and 684. *Illustrations.*

Pitcairn Island. *Globus* **75** (1899): 74–77. **Carlsen.**

Ein Bericht aus Pitcairn Island. Von Dr. F. Carlsen. *With Illustrations.*

Notes on Pitcairn island, from the narrative of one of the officers of H.M.S. *Royalist*, which visited the island in 1897.

Western Australia. **Smith.**

Western Australia. Geological Survey, Bulletin No. 2. 1. The State of Mining in the Kimberley District. 2. The Probability of obtaining Artesian Water between the Pilbarra Goldfields and the Great Desert. By R. Neil Smith, Perth, 1898. Size 8½ × 6, pp. 28. *Maps, Plans, and Sections. Presented by the Government Geologist, Western Australia.*

POLAR REGIONS.

Antarctic. *Ymer* 18 (1898): 275–320. **Ohlin.**

Om antarktiska färder och Antarktis. Af Axel Ohlin. *With Maps.*

A general account of antarctic exploration.

Antarctic. *J. School G.* 2 (1898): 369–379. **Taylor.**

Our Knowledge of the Antarctic. By W. A. Taylor.

Arctic—Spitsbergen Seas. *Ymer* 18 (1898): 321–348. **Nathorst.**

Om 1898 års svenska polarexpedition. Af A. G. Nathorst. *With Map and Illustrations.*

An account of Prof. Nathorst's cruise in 1898.

Spitsbergen Seas. *Verh. Ges. Erdk. Berlin* 25 (1898): 430–448. **Rüdiger.**

Herr Korvetten-Kapitän Rüdiger: Allgemeines über den Verlauf der Expedition nach dem europäischen Nord-Meer an Bord des Dampfers "Helgoland." *With Map.*

MATHEMATICAL GEOGRAPHY.

Cartography. **Gannett.**

Maryland Geological Survey. The Aims and Methods of Cartography, with especial reference to the Topographic Maps now under construction in Maryland by the United States Geological Survey, in co-operation with the Maryland Geological Survey. By Henry Gannett. (Special Publication, vol. ii. part iii.*a*.) Baltimore: the Johns Hopkins Press, 1898. Size 11 × 7½, pp. 245–335. *Maps and Illustrations.*

This work treats of the whole question of the construction of topographical maps, especially with the operations of surveying.

Cartography. **Zondervan.**

Proeve eener Algemeene Kartografie. Door H. Zondervan. Leiden: J. M. N. Kapteijn, 1898. Size 9½ × 6½, pp. xii. and 162. *Presented by the Author.*

A treatise on Cartography, with chapters on the history of map-making, on surveying, projections, representation of features, the reproduction of maps, map-measurements and criticisms, and a final chapter on school-maps.

Map-projections. **Euler.**

Drei Abhandlungen über Kartenprojection. Von Leonhard Euler. (1777.) Herausgegeben von A. Wangerin. (Ostwald's Klassiker der Exakten Wissenschaften, Nr. 93.) Leipzig: W. Engelmann, 1898. Size 8 × 5, pp. 78. *Price 1s. 2d.*

Reprint of two papers by Euler—one on the theory of the representation of a spherical surface on a plane, and the other on the geographical projection of the Earth's surface.

Position in Arctic. *Nautical Mag.* 67 (1898): 887–888. **Reeves.**

Dr. Nansen and his Lunar Tables. By E. A. Reeves.

Surveying—History. **Laussedat.**

Recherches sur les Instruments, les Méthodes et le Dessin topographiques. Par le Colonel A. Laussedat. Tome i. Aperçu historique sur les Instruments et les Méthodes. La Topographie dans tous les temps. Paris: Gauthier-Villars, 1898. Size 10 × 6½, pp. xii. and 450. *Maps, Plates, etc. Price 12s.*

This important work is interesting, not only from the historical sketch it gives of the origin of the methods of compiling plans from pictures, but from the fact that it owes its origin to the International Geographical Congress held in London in 1895. Colonel Laussedat, taking up the question of photographic surveying, which was one of the subjects suggested for treatment in the programme, was led to inquire into the history of picture plans, and ultimately to write the book of which the present volume is the first half.

Tides. *Science* 8 (1898): 810–814. **Hayford.**

The Limitations of the Present Solution of the Tidal Problem. By John F. Hayford.

A criticism of the accepted tidal theory.

Time and Longitude. *Rev. Scientifique* 10 (1898): 783–786. **Cugnin.**

Une question à résoudre en 1900: l'heure et la longitude universelles. Par M. E. Cugnin.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Physics. *Meteorolog. Z.* **15** (1898): 441–448. **Bezold.**
Ueber die Temperaturänderungen auf- und absteigender Luftströme. Von Wilhelm von Bezold.

Glaciers. *Petermanns M.* **45** (1899): 14–16. **Richter.**
Die Arbeiten der internationalen Gletscher-Kommission. Von Prof. Dr. E. Richter.

Land-forms. *Ann. G.* **8** (1899): 1–5. **Davis.**
Un exemple de plaine côtière. La plaine du Maine (Etats-Unis). Par W. M. Davis. *With Illustration.*

On the coastal plain of Maine as a typical example of coastal plains.

Land-slips. *Globus* **75** (1899): 24–28. **Greim.**
Ueber Bergstürze. Nach einem Vortrage von Dr. Greim. *With Profiles.*

Loess. *American J. Sci.* **7** (1899): 58–60. **Sardeson.**
What is the Loess? By F. W. Sardeson.

Arguments in favour of the purely æolian origin of the North American loess.

Meteorology. *Ann. G.* **8** (1899): 84–87. **Martonne.**
Sur un nouveau mode de représentation du régime des pluies dans les contrées intertropicales. Par M. E. de Martonne.

An ingenious diagrammatic form of showing the periods of rain and dry weather in tropical countries.

Meteorology—Pressure. *Meteorolog. Z.* **15** (1898): 361–387. **Hann.**
Weitere Beiträge zu den Grundlagen für eine Theorie der täglichen Oscillation des Barometers. Von J. Hann.

Also *reprint. Presented by the Author.*

Meteorology—Temperature. *Petermanns M.* **45** (1899): 19. **Supan.**
Vertikale Temperatur abnahme in der freien Atmosphäre. Von Prof. Dr. A. Supan.

Meteorology—Wind. **Dex.**
Rev. Maritime **132** (1897): 286, 479; **133** (1897): 18, 252, 533; **134** (1897): 101, 336. Fleuves aériens, leur cours, leur utilisation par les aérostats. Par M. Léo Dex. *With Maps, etc.*

Oceanic Life. **Herdman.**
The Twelfth Annual Report of the Liverpool Marine Biology Committee, and their Biological Station at Port Erin (Isle of Man). By W. A. Herdman, D.SC., F.R.S. Liverpool, 1898. Size 8½ × 6, pp. 56. *Illustrations. Presented by Professor W. A. Herdman.*

Oceanic Life. *K. Danske Vidensk. Selsk. Skrifter* **4** (1898): 410–454. **Steenstrup.**
Spolia atlantica. Kolossale Blæksprutter fra det nordlige Atlanterhav. Af Prof. Joh. Japetus Sm. Steenstrup. *With Plates.*

Describes and figures portions of a gigantic cuttlefish found in the Atlantic.

Physical Geography. **Davis and Snyder.**
Physical Geography. By William Morris Davis, assisted by William Henry Synder. Boston, U.S.A., and London: Ginn & Co., 1898. Size 8 × 5½, pp. xviii. and 428. *Maps and Illustrations. Price* 4*s.* 6*d.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Forlong.**
Short Studies in the Science of Comparative Religions, embracing all the Religions of Asia. By Major-General J. G. R. Forlong. London: B. Quaritch, 1897. Size 10½ × 7, pp. xxviii. and 662. *Maps and Illustrations. Presented by the Author.*

A mass of curious learning devoted to the elucidation of the common origin of all religions in primitive nature-worship.

Anthropology. *Petermanns M.* **45** (1899): 16–19. **Schurtz.**
Der Ursprung der Kultur nach L. Frobenius. Von Dr. H. Shurtz.

Commercial Geography. *Fortnightly Rev.* **65** (1899): 274–299. **Adams and Taylor.**
The Commercial Future. (1) International Struggle for Life; (2) The Commercial Sovereignty of the Seas. By Benjamin Taylor.

Commercial Geography. **Engelbrecht.**
Die Landbauzonen der aussertropischen Länder. Auf Grund der statistischen Quellenwerke dargestellt. Von Th. H. Engelbrecht. 3 vols. (Vol. iii., Atlas.) Berlin: D. Reimer (Ernst Vohsen), 1899. Size 11½ × 8, pp. (vol. i.) xii. and 280; (vol. ii.) x. and 384. *Presented by the Publisher.*

This very important work discusses the farm-crops and live-stock of all temperate countries, and includes an atlas of over eighty plates showing graphically the relative proportions of all other crops to grain, and of all other live-stock to cattle.

Commercial Geography. **Goulichambaroff.**
Commerce Universel au xix. siècle et le rôle qu'y joue la Russie. Par St. Goulichambaroff. [In Russian.] [With French *résumé.*] St. Petersburg, 1898. Size 11½ × 8, pp. xiv. and 230. *Presented by the Author.*

A short history of commerce is followed by an account of the chief commodities of importance in the nineteenth century, and a consideration of the part played by all commercial nations, especially with regard to their intercourse with Russia.

Historical. *B.S.G. y Estad. Rep. Mexicana* 4 (1898): 5-30, 73-92. **Buelna.**
La Atlántida, estudio presentado por el Señor Lic. Eustaquio Buelna en el Congreso de Americanistas.

This paper deals with the uncertain legends of early geographical discovery, touching on the position of Ultima Thule, and treating in some detail of the lost Atlantis.

Historical—Bibliography. ———
Catalogue de la grande collection exquise de Livres imprimés et Manuscrits, Cartes, Portraits et Estampes provenant de M. W. J. Roijaards van den Ham. Deuxième partie. Histoire et Géographie, Généalogie, Héraldique, Numismatique. Utrecht: J. L. Beijers, 1899. Size 9 × 7, pp. viii. and 192.

Historical—Maps. *B.S.R.G. d'Anvers* 22 (1899): 220-242. **Fiorini.**
Periplus. Traduit par M. J. Mertens.

A translation by M. Jules Mertens of a communication by Prof. Matteo Fiorini to the Italian Geographical Society, on the subject of Baron Nordenskiöld's great work on ancient maps.

Historical—Sea Power. **Mahan.**
The Influence of Sea Power upon the French Revolution and Empire, 1793-1812. By Captain A. T. Mahan, D.C.L., LL.D. 2 vols. London: Low & Co. [1892]. Size 9 × 6½, pp. (vol. i.) xx. and 380; (vol. ii.) xviii. and 428. *Maps and Plans.*

BIOGRAPHY.

Aitchison. *P.R.S.* 64 (1899): xi.-xiii. ———
Brigade-Surgeon James Edward Tierney Aitchison, M.D., F.R.S., etc.

Bässler. *Globus* 75 (1899): 28-29. ———
Dr. Arthur Bässlers Reisen und Sammlungen. *With Portrait.*

Dr. Bässler has travelled over a great part of the world studying ethnography and collecting specimens.

Gsell-Fels. *Deutsche Rundschau G.* 21 (1899): 185-186. ———
Dr. Theodor Gsell-Fels. *With Portrait.*

Dr. Gsell-Fels, born in 1818, was a popular writer on geography and travel.

Honter. *M.G. Ges. Wien* 41 (1898): 643-663. **Günther.**
Johannes Honter, der Geograph Siebenbürgens. Von Prof. Dr. Siegmund Günther.

A biography of the nearly forgotten Transylvanian geographer Honter, who was born in 1498. A copy of his 'Cosmographia' has recently been acquired for the Library.

Liburnau. *Deutsche Rundschau G.* 21 (1899): 182-184. ———
Dr. J. R. Lorenz Ritter v. Liburnau. *With Portrait.*

Marche. *Deutsche Rundschau G.* 21 (1898): 135-136. ———
Alfred Marche. *With Portrait.*

M. Marche travelled extensively in West Africa, and by his explorations assisted in extending the French colonial empire.

Ruge. *XXVI. Jahresb. Ver. Erdk. Dresden* (1898): iii.-iv. ———
Sophus Ruge. *With Portrait.*

Prof. Ruge has completed the thirty-fifth year of his presidency of the Dresden Geographical Society.

Simony. **Penck.**

Frederick Simony. Leben und Wirken eines Alpenforschers. Ein Beitrag zur Geschichte der Geographie in Österreich von Dr. Albrecht Penck.—Geographische Abhandlungen. Herausgegeben von Prof. Dr. Albrecht Penck. Band vi., Heft 3. Wien: E. Hölzel, 1898. Size 11 × 7½, pp. 116. *Photographs, etc. Presented by the Author.*

Thoroddsen. *Deutsche Rundschau G.* **21** (1898): 133–135. ———

Dr. Thorvaldur Thoroddsen. *With Portrait.*

GENERAL.

British Empire. **Dilke.**

The British Empire. By the Right Hon. Sir Charles W. Dilke, Bart., M.P. London: Chatto and Windus, 1899. Size 8 × 5½, pp. 160. *Price 3s. 6d. Presented by the Publishers.*

This little volume consists of a series of essays published in various periodicals by the author during 1898, and dealing with the political and economic conditions of the British Empire. The chapters touch on a bird's-eye view of the empire, India, the Dominion of Canada, Newfoundland, the Commonwealth of Australia, New Zealand, Africa, Crown Colonies, imperial defence, and a few hints on books, entitled "How to study the Empire."

British Empire. *Nineteenth Century* **45** (1899): 226–234. **Hurd.**

An All-British Cable System. By Archibald S. Hurd.

Educational—Methods. *J. School G.* **2** (1898): 321–328, 379–385. **Merrill.**

A Suggestive Course in Geography. By J. A. Merrill.

Exchanges. **Norman.**

The World's Exchanges in 1898. By John Henry Norman. London: Low & Co., 1898. Size 8½ × 5½, pp. 54. *Price 1s. 6d. Presented by the Author.*

Tables of the sterling value of foreign currencies.

Geographical Work in Austria. *M.G. Ges. Wien* **41** (1898): 717–738. ———

Bericht über die Leistungen österreichischer Staatsinstitute und Vereine auf geographischen und verwandten Gebieten im Jahre, 1897.

Geology and Engineering. *P.I. Civil Engineers* **134** (1898): 254–277. **Dawkins.**

On the Relation of Geology to Engineering. By Professor Boyd Dawkins, F.R.S. *With Illustrations.*

German Colonies. ———

Weissbuch. Neunzehnter Theil. Berlin: C. Heymann, 1899. Size 13 × 9½, pp. 218.

Annual reports and memoranda on the development of the various German possessions.

Minerals. **Fletcher.**

British Museum (Natural History). Mineral Department. An Introduction to the Study of Minerals, with a guide to the Mineral Gallery. By L. Fletcher. Printed by order of the Trustees, 1897. Size 8½ × 5½, pp. 124. *Plan. Presented by the Trustees of the British Museum.*

Museum Report. **Brigham.**

Occasional Papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History. Vol. i.—No. 1, Director's Report. Honolulu: 1898. Size 9½ × 6, pp. vi. and 72. *Illustrations.*

NEW MAPS.

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Norway. **Norges Geografiske Opmaaling.**

1. Generalkart over det sydlige Norge i 18 Blade. Scale 1 : 400,000 or 6·2 stat. miles to an inch. Sheet xiii. 1896.—2. Topografisk kart over kongeriget Norge. Scale 1 : 100,000 or 1·6 stat mile to an inch. Sheets: 4a, Flekkefjord; 27a, Vermunden; 27c, Sandkildfossen; K 16, Junkeren; L 15, Nasa; L 16, Virvand; L 17, Mosjöen; S 3, Loppen; T 2, Galten; T 3, Söröen; Y 4, Polmak.—3. Soudre Trondhjems Amt II. Scale 1 : 200,000 or 3·2 stat. miles to an inch. E sheet, Norges Geografiske Opmaaling, Kristiania. *Presented by the Geographical Institute of Norway.*

ASIA.

Shantung. **Hassenstein.**

Karte der Provinz Schan-Tung mit dem deutschen Pachtgebiet von Kiau-tschou. Hauptsächlich nach japanischen und chinesischen Quellen entworfen und gezeichnet von Dr. Bruno Hassenstein. Scale 1 : 650,000 or 10·2 stat. miles to an inch. Gotha: Justus Perthes, 1898. *Price* 4 *marks.*

This map of Shantung has been principally compiled from Chinese and Japanese sources. It contains a large amount of valuable information, both on the map itself and in the notes and letterpress which accompany it. The extent of the British and German concessions at Wei-hai-wei and Kiao-chau are shown, all roads, tracks, telegraph lines, and projected railways are laid down, and all systems of inland navigation are indicated.

AMERICA.

Nicaragua. **Sonnenstern.**

Official Map of Nicaragua. Compiled by order of His Excellency the President, General Don Jose Santos Zelaya, from Surveys by Maximiliano Sonnenstern, Govt. Civil Engineer, assisted by William P. Collins, G.C.E. Revised up to date, 1898. Published by H. G. Chalkley, Chicago. On rollers. *Price* $10.

This map is based on the surveys of Maximiliano Sonnenstern, and professes to have been revised to 1898, although the compiler does not appear to have made good use of the map of North-Eastern Nicaragua, from a survey of Mr. J. M. Nicol, C.E., 1897, which was published in the *Geographical Journal*, June, 1898.

In addition to the general map, there are sections of the proposed Nicaragua inter-oceanic canal, and inset plans of the ports of Corinto, San Juan del Norte, and San Juan del Sur.

AUSTRALIA.

Northampton, Western Australia. **Maitland.**

Geological Map of Northampton, Western Australia. Scale 1 : 15,840 or 0·25 mile to an inch. A. Gibb Maitland, Govt. Geologist, 1898. Geological Survey of Western Australia. 2 sheets. *Presented by the Author.*

The topography of this map is drawn from a plane-table survey by S. J. Becher, on which the geological formations are shown by Mr. A. Gibb Maitland. The hill-work is shown by contour-lines, and an index is given of the colours and signs employed.

Sydney. **Robinson.**

Map of the City of Sydney and adjacent suburbs. Lithographed and published by H. E. C. Robinson, Sydney, N.S.W. Scale 660 feet to an inch. *Presented by the Publisher.*

This map is clearly drawn and printed in colours. Soundings in feet are given, and the city and municipal boundaries are laid down.

CHARTS.

British Columbia and Alaska. **Jenkins.**

British Columbia and Alaska from Victoria to Bering Sea. Scale 1 : 3,636,864 or 57·4 stat. miles to an inch. H. D. Jenkins, F.R.G.S. Published by James Imray & Sons, London, 1899. *Presented by the Publishers.*

Norwegian Charts. **Norges Geografiske Opmaaling.**

1. Specialkart over den Norske Kyst fra Strömöerne til Tjötta. Scale 1 : 50,000. 1898.—2. Specialkart over den Norske Kyst Vefsen og Leirfjorden. Scale 1: 50,000. 1898.—3. Specialkart over den Norske Kyst fra Hitteren til Kraakvaagö og fröien. Scale 1 : 50,000. 1896.—4. Specialkart over Trondhjemsfjorden. Scale 1 : 100,000. 1898.—5. Specialkart over Trondhjemsfjorden. Scale 1 : 100,000. 1898. Norges Geografiske Opmaaling, Khristiania. *Presented by the Geographical Institute of Norway.*

United States Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for March, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Transvaal and Natal. **Melvill.**

Seventeen Photographs of the Transvaal and Natal, by E. H. V. Melvill, A.M.I.C.E., Government Surveyor. *Presented by E. H. V. Melvill, Esq.*

This series of photographs represents scenery and natives of Natal and the Transvaal. The following are their titles:—

(1) Crossing Komati river; (2) Crossing Komati river; (3) Graves of British officers and men, Bronkhorst Spruit; (4) Boundary beacon, Ressano Garcia, Portuguese Transvaal boundary; (5) Natal natives; (6) Washing-women, Pietermaritzburg; (7) Howick falls, 308 feet high, Natal; (8) Native women, Natal; (9) Native dance, Natal; (10) Railway Station, Lower Umkomaas; (11) Railway bridge, Umkomaas river, Natal; (12) The Cliffs, Umkomaas river; (13) Park, Pietermaritzburg, Natal; (14) Pavilion, Pietermaritzburg; (15) Umkomaas river; (16) River scene, Irene, near Pretoria, Transvaal; (17) Stewards' Handicap, Christmas Meeting, 1898.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

Pub

The

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THE USE OF PRACTICAL GEOGRAPHY ILLUSTRATED BY RECENT FRONTIER OPERATIONS.*

By Colonel Sir THOMAS HOLDICH, K.C.I.E., C.B., R.E.

All good geographers will rejoice in the fact that a school of geography is likely to be started at the University of Oxford, the first school of its sort that has ever been inaugurated in England. And, if we think of the vast interests that England owns in the wide world of geography, her colonies, her conquests, and her commerce, it seems strange indeed that, in recognizing the necessity for the inclusion of geography in her wide curriculum of university teaching, she should have waited on the initiative of other countries, whose interests are but the shadow of her own. But university teaching, immensely valuable as it cannot fail to be, can hardly extend beyond the academic stage. The processes of geographical evolution in all their many branches, the intimate relation of geography to history, to archæology, to geology, together with something, perhaps, of the rudiments of those methods by which geographical facts are represented (*i.e.* cartography), all these things may be taught effectually in such a school, but into the regions of the hard practical attainment of geographical knowledge it can hardly enter. It is this practical phase of the subject that I wish to introduce to your notice to-night, and to show you, if I can, of what immense importance it is to our national business, whether commercial, military, or political.

A knowledge of geography most intimately affects matters naval and military. On this point there is no division of opinion now, whatever there may have been formerly. And because the importance of this knowledge is so fully recognized by our sailors and our soldiers, I need not enlarge on it, even if there were time to do so. No military or naval force of any importance ever takes the field in these days without being fully equipped with all the means for acquiring geographical information, whether in the aggregate for strategical purposes, or in detail for minor tactical operations. And if a project is afoot for investigating the remoter problems of ocean geography, nine times out of ten that project will be initiated by a sailor and be supported by the navy. The roll of our military and naval explorers is a long one, and a splendid one; so that it was, perhaps, not altogether inappropriate that the Geographical Society's delegation to Oxford to arrange the preliminaries for the new school should have included representatives both of the navy and the army.

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* Read at the Royal Geographical Society, March 13, 1899.

But when we turn to the civil, particularly the commercial, side of the question, it is still a surprise to me that the value of full geographical knowledge has not been more widely recognized. It would not be difficult to adduce instances in which thousands, not to say millions, of pounds have been misspent for the want of that preliminary information which only complete mapping can give. We will suppose that a railway scheme is projected in a comparatively unknown sphere. The first and obvious means of estimating its chance of success is to examine existing trade routes, and to count up the amount of traffic that passes along them. This is all very well, and, indeed, it is necessary; but it is often forgotten that there are radical points of difference in those conditions of land conformation which govern railway construction, and those which govern a trade route. The one sacrifices grade to distance, and is content to climb over mountains, so long as climbing mountains affords the most direct way to its object; the other sacrifices distance to grade, and would much prefer to crawl round the mountains, so that the gradients are easy. And thus it happens (I could quote a very remarkable instance) that one or two alternative routes are traversed and examined and estimates are made for expenditure in railway construction, and that vast sums are finally expended over a difficult alignment, when a fair and square geographical survey, covering a wide area, would have revealed a far easier, less expensive, and possibly even a more productive route, following a line that was never even dreamt of. This is the sphere of practical commercial geography, and in the business of the world it covers a far wider field than the mere alignment of railways. This phase of the subject is, however, scarcely less comprehensive than that of military requirements, and it is impossible to follow it further in the short space of time that is at our disposal.

It is, perhaps, in those international negotiations and agreements which concern the political status of great countries, and determine their boundaries and the respective limits of their responsibilities, that the danger of inaccurate geographical knowledge is greatest, and the results of it are the most disastrous. Truly this period in our history has been well defined as the boundary-making era. Whether we turn to Europe, Asia, Africa, or America, such an endless vista of political geography arises before us, such a vast area of new land and sea to be explored and developed; such a vision of great burdens for the white man to take up in far-off regions, dim and indefinite as yet; that it can surely be only by the grace of Providence that we shall finally emerge from the struggle to rearrange the world's partitioning, without some deadly contest with others whose interests in these new arrangements are hardly less than our own. And I may, perhaps, be permitted to say, that just as the Providence of battles usually favours the biggest battalions, so it is likely that the widest geographical knowledge will prove the best safeguard against misunderstandings, and will at once dispose of such false estimates of the value of portions of the world's surface here and there as have occasionally brought England perilously close to the dividing-line between peace and war. By geographical knowledge I do not mean simply that knowledge of the Earth's surface which we gain by surveying it. I mean also a knowledge of those ordinary laws of nature which decide the configuration of mountains and the flow of rivers, where certain influences must inevitably lead to certain conditions. I mean, also, such knowledge of the technical application of geographical terms as will prevent misunderstanding about the meaning of words and phrases.

Of all sources of international irritation, boundaries seem to be the most prolific; and of all countries in the world England has probably suffered most from them. To refer to modern history only, it was the Sistan arbitration which first turned Sher Ali's heart against us, and originated the Afghan war of 1879–80; it was a boundary which brought England and Russia face to face in Turkestan in 1884, and so nearly forced us into war; it was a boundary (nothing less) that started Umra Khan on his quest for Chitral; it was a boundary which set all the north-west frontier in a blaze lately. And yet all this boundary-making has been in the interests of peace alone. The want of these boundaries would more surely have led to wider-spread, more disastrous war than the making of them, and it seems of all things most extraordinary that efforts honestly made in the interests of peace and good government should not be possible, without bringing great countries to the verge of blows.

Well, in my opinion it is very much more possible than our recent experiences would seem to prove, and it is my belief, looking back over the boundary episodes of the last twenty years, that the greater part of the political difficulties which have arisen in connection with boundary demarcation have been due to a want of appreciation of the necessity for a sound geographical basis to the text of treaties and agreements. Misunderstandings, delays, expense, and mutual international mistrust have over and over again arisen from quite insignificant causes connected with inattention to exactness in geographical definitions, if not with actual geographical ignorance. When a man makes a will, he is careful that his intentions should be expressed in language which is at least technically accurate, if not always intelligible to ordinary understanding. Such safeguards are not always adopted by statesmen in drawing up the terms of international agreements, and the result is that the actual geographical facts of nature will not always tally with the agreements. If I give a few examples to illustrate my meaning, please understand that they are not altogether hypothetical cases, but that I am referring to actual occurrences where either want of definition, inexact definition, or positive geographical ignorance, has led to complications so awkward as to have involved, not only delay and its attendant expense, but political misunderstandings and irritation, which has not, in some cases, disappeared to this day.

If we take such an ordinary expression as "the foot of the hills," for instance. What is the meaning of the term? Most people would be prepared to explain it offhand, but a little consideration will show that it is capable of various interpretations. Where a mountain mass shelves down in precipitous slopes, ending with a rushing torrent at the foot, there can be no mistake; when you arrive at the torrent you are certainly at the foot of the mountains. But when these more or less precipitous slopes end in shelving spurs, gradually tailing off into long sweeps of upland, gently sloping downward and away to a placid river flowing in the midst of a valley, where is the foot of the hills then? Is it where the steep gradients cease, and you step off the rising mass of craggy hillside to the gentle declivities of grassy slopes, trending away to cultivation and villages and orchards? or is it where you come to the river-banks in the midst of the valley? The decision in this case led to most awkward misunderstandings with Afghanistan. Take another case. "In an easterly direction." What is an easterly direction? Is it as nearly due east as it can be made? or is it a little east of north, or a little east of south; anywhere, in fact, except either westerly, or due north, or due south? This was a question which had to be decided on the Pamir boundary, and it was decided at last in the latter sense rather than the former. These are cases of want of definition. As for inexact definition, *i.e.* the use of geographical terms in either too limited or too extended a sense, other great countries besides England have suffered to an extent that is absolutely incalculable from their use. Every one knows that there is nothing like a good strong natural feature as a state boundary—something which every man can recognize from afar, and which he cannot mistake if he encounters it. Such features are found in rivers, and in water-divides, and they have been impressed into the service of international boundaries all the world over. But they cannot always be utilized, and then recourse must be had to artificial demarcations, which are good enough when they take the form of the great wall of China, but which can be made productive of endless mischief when they are adopted lines of latitude or longitude, or any other form of line which has to be marked out by artificial and perishable erections. Under certain conditions rivers are good; under others (as, for instance, when they change their course, and their channels absorb valuable ground, or throw up unexpected islands in a highly cultivated country) they are bad. The channel of a river under these circumstances is a most undesirable boundary. Watersheds, or water-partings, are the best of all possible natural boundaries, for they are liable to no change, and are readily recognizable. But even great central watersheds must be treated with care, and the bigger and more unmistakable they are, the more care do they require. To take a hypothetical example. Supposing it were a matter of determining a boundary between India and Tibet. Standing back some 100 miles from the plains of India, in the centre of the Himalayan mountains, is a magnificent central watershed (or water-parting), which stretches from Kashmir to northern Assam. The greatest snow-peaks and glaciers of the world are piled on to the summits of this vast crystalline axis of the Himalaya. Could anything be better than this magnificent array of unapproachable snow and ice to serve as the unmistakable barrier between two vast Asiatic countries? Nothing could be better, provided we do not define it as the watershed between India and Tibet. From its southern flanks the first beginnings of many mighty rivers flow southward to the plains of India; from its northern

THE BURZIL PASS.

buttresses and spurs many a torrent pours northward—and turns equally to the plains of India. The Indus and the Brahmaputra drain the northern slopes of the central Himalaya, enclosing the great mountain system between them, whilst the largest affluent of the Ganges cuts it right in two.

What is true of the Himalaya is true of nearly all the great mountain systems in the world, *i.e.* the watershed of the system is beyond, and apart from, the highest mountain chain. This is true also, in a smaller sense, of smaller ranges—so as to make it essentially necessary to distinguish between a central chain of peaks and the water-divide of the system as a whole. One other example of incorrect definition will perhaps appeal to you more directly, for you will know where its application comes in if you remember the disputes which arose about the Oxus. The source of a river is sometimes adopted as a definite geographical point in a boundary agreement, regardless of the fact that every great river in the world must have several sources. To indicate that the source intended is to be the source of the principal affluent, is merely to invite a storm of dispute. How are we to reckon up the principal affluent? Is it the longest, or the widest, or the one which carries most water? Does it not occur to you that the solution of such a problem is almost hopeless. And what, after all, is the source of a stream? for it is the streamlet that we finally get to. In some few cases it may be a definite spring; in many cases it is an indefinite glacier; in hardly any case can it possibly be a lake. Lakes are, as a rule, but incidents in the course of a stream or river—a widening and deepening of the river-bed which permits of the collection of water. There are doubtless lakes that have no streams running into them, but which are fed by subaqueous springs. But they are not usual, and the existence of such springs is not easily ascertained.

But I will pass on to the more serious matter of positive geographical ignorance, *i.e.* the inclusion of topographical features by name which either do not exist at all, or which may exist in too great a quantity. As to the latter, I could remind you of the hopeless confusion which arose during the delimitation of the boundary between Kafiristan and Chitral, owing to the fact that two separate and important rivers of the same name were found in the same region. The danger of too free a use of place-names could hardly have been more forcibly illustrated, for it led to an absolutely new alignment of an international boundary, and a new phase of political responsibility. As to the former, I may be permitted to refer for once to a specific instance, because I shall be dealing with what is now ancient history, and the example is too apropos to be overlooked. In the year 1884, a mission started from India to fix the boundary between Afghanistan and Russia. The amount of boundary actually to be found and demarcated was inconsiderable—about 300 miles—and the field of operations, though rough, remote, and inhospitable (especially in winter) was well enough adapted for geographical surveying. It was almost unknown before the mission started, but still maps of some sort had to be accepted as the basis for agreement, and on one of them was found an apparently suitable point on the Oxus for assisting the process of boundary definition, called Khwaja Salah. There were eight or ten political officers on that mission, besides a large native political staff. Fifteen hundred men and fifteen hundred animals started from India alone, and they met another large contingent from Europe. You will remember that the work of the mission did not progress rapidly, and that it was two years ere it returned to India with that work only partially accomplished. The expense of it, and the suspense of it—the bitterness and hostility that were aroused, are matters that I do not wish to refer to further than to say that they were accentuated by delay, and that delay was largely increased by the necessity for hunting for the post of Khwaja Salah. We never found it. There was a district of the name, and a ziarat, but no "post" such as was described. I need hardly say that opinions differed even within the limits of our own camp, nor remind you that there was another camp which also held most decided views of its own. The question was never settled, the post of Khwaja Salah was never found, and I am now free to express my own opinion that it had been washed into the bed of the Oxus so many years ago, that nobody could exactly remember when the accident happened. That is a specific instance, but, as a matter of fact, the work of that mission was one unceasing hunt for a possible boundary within impossible limits, because those limits were laid down on a basis of what can only be called geographical ignorance. For there *are* impossibilities in demarcation. On another and later occasion, a boundary was defined as running parallel to a river at a distance of 4 miles from it. This 4 miles carried us into an indefinite region neither at the top of a mountain range nor the bottom of it, but hanging as it were in mid-air, surrounded by such a vast chaos of crags, spurs, and precipitous cliffs, that no one could possibly have demarcated a yard of boundary in such a position.

One last hypothesis I will venture to suggest as a close to this part of the subject, and I suggest it with all deference. Seeing that final political action has, after all, to wait on the evolution of geography, or, in other words, that no final agreement can be come to without the preliminary evidence of completed maps; and that such agreement is seldom effected in the actual field, but usually by the high contracting parties of either government acting in concert at home; would it not be better to save the delays, and the expense, and the chance of arousing bitter feelings of animosity, by obtaining this preliminary geographical information first (without raising one single political argument), and settling the matter on geographical evidence afterwards? Now, it seems to me that a full knowledge of the *use* of geography must inevitably lead up to this conclusion. In support of it, I may adduce yet one more instance.

About the same length of boundary (*i.e.* 300 miles) had to be settled and demarcated in another country, equally rough, more inhospitable, almost as remote; and the business lay with people as changeable and difficult to deal with as any in the East. But in this instance the maps were ready, and there was little or no room for discussion, and no opportunity was allowed for hatching new objections. In a month, or a little more than a month, that boundary was all settled, and it was settled just in time. Clouds had arisen on the horizon even in that short space, and within a month of its completion a storm had burst which would have shaken an incomplete agreement all to pieces.

So much, then, for the advantages of accurate geographical knowledge to state purposes. We will now consider, as far as space permits, how to get that knowledge, for this is perhaps the most practical business of all.

Assuming, then, that in all the great practical business of life, whether military, commercial, or political, which is based on geographical fact, it is admitted that accurate geographical knowledge is so great a preliminary advantage, that no effort should be spared to attain it, I have something to say about the methods which should be employed in order to attain it. It is easy to say, "Let us have accurate maps, by the light of which we may form our opinions and settle our differences," but it is not always so easy to get them. It is, however, very much easier than is generally supposed, and I speak from experience when I say that in matters commercial or political it is the shortest, as well as the cheapest, way to the desired end. I am not going to inflict on you any technical details. I only wish to draw a sharp distinction between accurate geography, and the geography of the traveller or prospector who is content with what falls under his immediate observation in certain limited areas. We want, for public business purposes, in the rapidly developing lands of the future very much more than that; we want sound, square, geographical maps, of which the topography is equally balanced in value over all the map, and in which the whole mapping is based on systematic measurement, the correctness of which can be proved. The only way I know of to attain such mapping is to triangulate first, and to complete the topographical details on the basis of the triangulation. This is all the technical information I need trouble you with, but this much is of infinite importance; it is worth remembering; and the principles of it should be inculcated in every geographical school that exists. The advantage of triangulation is this. In the first place, you cover the country with a scattering of fixed points, which are the guiding signs and landmarks for all subsequent operations whatsoever. So long as two or three such points are visible, no one can ever again complain of difficulty in discovering his exact position on the world's surface. In the second place, you establish a double record. There is the geographical record of the completed map, and there is the mathematical record of the computations which establishes its correctness. Two people may represent the same country in totally different ways, and each claim superior accuracy. So far as the maps go, it is impossible to decide between them; and it might be necessary to travel far and spend much time in ascertaining their relative correctness. This cannot occur if the country is triangulated. Observations may indeed go astray, but the resulting computations at once prove their weakness—at once show which are right and which wrong, and establish a final record which admits of no argument, and from which there is no escape. Every point on a boundary-line, every peak in a mountain system, every landmark of any importance in the country-side, has a value whose correctness can be proved just as easily in a London office as in the open field. And this value is not only incontrovertible, but absolutely distinctive, because every point on the whole world's surface has its own special position in terms of latitude and longitude, with which no other point can interfere. There is no necessity for inexact geographical definitions, no calling of places by their wrong names, no chance of confusion or possibility of future discussion, so long as a point is defined by its co-ordinate position in latitude and longitude. I cannot follow this subject further, though there is much more to be said. I can only add that, in my opinion, a survey without a mathematical basis is no survey at all.

LAKE VICTORIA.

The one objection most frequently raised to this geographical system of mapping (which we may fairly call the Indian system) is that it is so difficult; that there are large areas of country which it would be impossible to triangulate; and that, at best, it takes time. Its difficulties are very much exaggerated in these days, when such splendid instruments are available; and as for the time it takes, we have found that we can easily hold our own against any other system that is worth calling a system at all, and that even under the pressure of moving forward by daily marches at a rapid rate through open country, triangulation can generally be maintained. But it doubtless requires room to see around, and I admit that in the dim twilight forests of Africa, for instance, it might be necessary to resort to more elementary methods of measuring distances. I have never seen any impossible country; the jungles and forest-clad plains of India and Ceylon have all been triangulated, and the highlands and plateaus of Persia, Baluchistan, Afghanistan, Turkistan, or the Pamirs, are all open country. But there are doubtless circumstances under which triangulation may be exceedingly difficult, if not impossible, and it is with an illustration or two of such exceptional conditions that I will conclude my paper.

In the long narrow ice-bound valleys which lead up from the Hindu Kush to the Pamirs, where one can only see, towering thousands of feet above, the lower knobs and buttresses of gigantic spurs which intersect the glaciers of the mighty ranges on either hand—where the wind whistles down with the force of steam and the temperature of ice; we were once, to use a familiar term, fairly bunkered. We had got our triangulation up so far without the assistance of a day's halt even, and now came the difficulty. We couldn't climb out of it; we could only work along with short bases and long narrow intersections. We had to stick to it, for triangulation was important. For aught we knew, the Russian surveyors would have their triangulation to support their contentions, and if they had and we had not, we should have been at a scientific disadvantage. Moreover, the question of latitude was an important one. Much depended on the latitude of Lake Victoria, and although under ordinary circumstances latitude values can be obtained with all necessary precision by astronomical observations, it was not at all a certainty that they could be so obtained on the Pamirs. Where masses of mountains exist, there is, unfortunately, a liability to error introduced which cannot be readily calculated, and the amount of such error may be very large indeed. We laboured on as best we could, but it is an open question whether triangulation under such conditions would have proved satisfactory, or beyond challenge, when we were suddenly relieved of all our difficulties. One glorious day, when the mist-wreaths had disappeared from the snow-capped peaks, and rivulets had become rushing torrents, Colonel Wahab climbed up an exceedingly high mountain (we surveyors think 19,000 feet a very fair climb), and across the back of the distant Hindu Kush he saw the line of Kashmir peaks, fixed by Tanner in former years, pointing the way to direct connection with Indian triangulation, and at once providing us with exact conclusions for the basis of our work on the Pamirs. These peaks were seen again on subsequent occasions. Three days only were lost in attaining exact results, and they were three very well expended days, for thereafter we were, in a scientific sense, masters of the situation, and our junction with Russian surveys in Trans-Caspia was a complete success. The point of this story lies chiefly in this, that we were helped out of our difficulties by the prevision—or provision, I might call it—of another surveyor, Colonel Tanner, whose own geographical surveys were widely apart from ours. It was the unforeseen value of his triangulation that points the moral of this tale.

Once again we were in difficulties. We were in the lower Chitral valley during that uneasy time when all the frontier was ablaze; we were, in fact, outside Chitral at the time when some of our friends, to whom we had looked for assistance in demarcating the boundary between Chitral and Afghanistan, were inside, and couldn't get out. When we first appeared in the Kunar valley as guests of the Amir's commander-in-chief, Ghulám Haidar, a very pretty fight had just been raging between him and Umra Khan of Bajaor. Between us and Chitral, in fact, Umra Khan had possessed himself of the valley along which it was our business to survey, and he barred our way. Whether he guessed that boundary demarcation would turn him out of that valley, I cannot say, but instead of coming into our camp to represent his own claims, he started on the warpath for Chitral. A curious change came immediately over the spirit of that frontier drama. Across the hills separating our valley from Bajaor, the genial giant Ghulám Haidar metaphorically stretched out the hand of

PILLAR NO. 1, AT EAST END OF LAKE VICTORIA, ON WHICH THE RUSSIAN AND ENGLISH SURVEYS CLOSED TO A CONNECTION.

friendship to Umra Khan, and in a spirit of almost Christian forgiveness the latter helped himself from that Afghan army which was our protection to assist his progress to Chitral. He even suggested that, should he not meet with all that success which he undoubtedly deserved, he would send his wife and family for protection to our camp. We already had the Chitral refugees—relations of the lately murdered Mehtar—so our company promised to be mixed. Inside Chitral our friends were having a worse time than we thought, for we had comforted ourselves with the reflection that four hundred Sikhs and two guns were more than a match, inside good defences, for as many Chitral bandits or Pathan deserters as might array themselves against them.

Anyhow, the circumstances were not promising for triangulating the Chitral valley. Triangulation, indeed, was impossible. Once again, however, we were helped out of our difficulties by the prevision of a past race of surveyors. We knew that if we could only gain the mountains of Kafirstan overlooking Chitral, we should sight the great peaks long ago fixed by Carter (now Colonel Carter Campbell) from the neighbourhood of the Indus, and our difficulties would be ended.

Something had to be done, or we should determine no boundary at all. So we persuaded Ghulám Haidar to give us an escort of five hundred of his trusty warriors for an expedition into the land of the Kafirs. Never shall I forget that fortnight's trip into the Kafir highlands. It was the time when the wild almond blossoms covered the steep hillsides down to the river's brink, when lilies and violets and strange forms of honeysuckle were brought to decorate our tents; a time of spring sunshine that preceded that time of bitter winter snow which blocked the way for Kelly's force between Gilgit and Chitral. We wandered through thickets of wild fig and olive, under craggy cliffs covered with ivy—where the wild vine held together the crumbling rocks, under the shade of deodars, and up into forests of oak, the like of which I have never seen elsewhere. The acorns were treble the size of any ordinary English acorns, and I am pleased to think that a young tree sprung from one of them is now growing up at Simla. Beyond the forests we struck into the snow-bound hilltops, and finally we reached a point where a gigantic mass of craggy outcrop marked an unmistakable feature in the mountain landscape.

Here the situation was striking enough. All around us were the snowy mountains of Kafirstan and the Peshawur frontier, an apparently dead level of white undulations, broken only by the dark lines of jagged and splintered outcrop, but dominated here and there by those higher summits which had been fixed from afar by Indian triangulation. Almost at our feet was the black valley of Chitral, where our friends were fighting for their existence, and stretching away northward was the long sinuous line of dividing watershed which was to carry the boundary from the Hindu Kush to the neighbourhood of our camp on the

Kunar river. It was all spread out as in a map. There was no further difficulty in completing the necessary topography, and a few days' work secured the success of the expedition. Then we came down again, and I wish I had time to tell you of the manœuvres of our Afghan escort through the snow, which was sometimes up to their necks. Without transport, or commissariat, or medical arrangements, or tents of any sort or kind, five hundred Afghan soldiers followed us up those mountains, and followed us down again, guarding us closely, for there was no telling what the Kafir might not take it into his head to do. Not a man was the worse for it, as far as I know.

Here again I wish to impress on you that but for the prescience of our departed chief, General Walker, who possibly foresaw that geographical triangulation might well prove to be of paramount importance even in the future interests of frontier policy, and who started Captain Carter on that series of difficult operations from the Indus which ended in giving us help at an urgent hour of need, the Indian Government would certainly have had no fixed frontier at that time, and might possibly have been waiting for it even now.

And so I end as I began. The academic study of geography in its relation to ancient history, to archæology, to anthropology or geology, is of infinite use in assisting to solve the problems presented by these sciences, and the first establishment of a school at the university which will facilitate and encourage this study marks an epoch in the progress of geographical knowledge on which we may well congratulate ourselves.

But it is not quite all that is required. Something of the theory and the results of its practical application to the business of life, to commercial business, and to political business, is also wanted. Our soldiers and our sailors know how to make geography, and how to make use of it. I sometimes think that our merchants and our statesmen would make better use of it if they knew also how to make it, and if they fully appreciated the absolutely immeasurable cost of geographical ignorance.

Before the reading of the paper, the PRESIDENT said: This is not the first time that a meeting of this Society has had the pleasure of Sir Thomas Holdich's company, and I am quite sure we shall have as interesting a paper as we had last time he addressed one of our meetings. There is likely to be, I hope, considerable discussion of the paper afterwards, and therefore I will not detain you longer.

After the reading of the paper, the following discussion took place:—

General Sir PETER LUMSDEN: I congratulate the Royal Geographical Society on having secured such a practical master of his subject as my old friend Sir Thomas Holdich, who has so ably expounded the political, commercial, and economical necessity to this country of geographical educational development. I will not soar with my friend to the watershed of the Himalayas, or the Hindu Kush; nor will I descend these vast slopes to seek for his frontier along the foot of the hills; nor will I grope in the depths of the Oxus to seek for that geographical point, that will-o'-the-wisp, the Ziarut of Khwaja Salah, which he assured us was ages ago swept away by the river. We need not go to the steppes of the Pamirs or the sources of the Nile to corroborate the stern facts which Sir Thomas Holdich has placed before us this evening, to illustrate the necessity of increased geographical education in this country; these facts are known to us, and they are so numerous that it would be out of the question to attempt categorically to enter upon them. I will only adduce one example in this country from my own experience, which caused a great deal of misunderstanding, and no small amount of correspondence. It was with regard to the practice prevalent amongst Scottish lawyers and factors of using the expression "skyline" as denoting the crest of the ridge or hill dividing two properties. However happy the expression "skyline" may be, and definite with regard to its nautical application to the sea-horizon, I think we ought to keep it at sea and not bring it ashore, where it is certainly perfectly indefinite and unintelligible, for I think it stands to reason that a "skyline" of that description must depend on the position of the observer, as it increases or decreases according as we approach or go away from the crest of the hill. I am content, and I dare say a good many in this room are equally so, to accept the testimony given by such a distinguished engineer, explorer, and competent surveyor as Sir Thomas Holdich, who for the past score of years has had unexampled experience in all matters connected with delimitation of national frontiers, and has so forcibly placed before us the knowledge he has gained in these operations. I trust that the Council of the Royal Geographical Society will be able to use its influence with the Government and people of this country, to secure for this national want of geographical education something of the same response which another Engineer officer so lately procured for education in the Sudan.

Lieut.-Colonel Leverson: I thoroughly agree with all Sir Thomas Holdich has said with reference to the importance of geographical knowledge in the determination of international boundaries. Maps, even if more or less accurate, are not alone sufficient. In order that full advantage may be taken of them, they must be supplemented by an intimate acquaintance with the physical and political geography of the districts they embrace. It is not enough to know the exact course of rivers or streams; one also wants to know their nature and peculiarities. From a delimitator's point of view, most rivers and streams afford good frontiers, except such as are liable to alter their courses or throw up islands; but a statesman must select a frontier which is not only good as a line, but which in other respects is likely to prove satisfactory. Small streams may be objectionable as likely to be the cause of quarrel in connection with drinking and washing rights, or water required for irrigation purposes. In the case of large rivers, it may be found that if the ownership of the banks were to be in different hands, the arrangements for the improvement of navigation, and for police supervision for fiscal purposes, would be likely to give so much trouble that it would be better to seek a frontier elsewhere.

Sir Thomas Holdich has referred to watersheds or water-partings as the best of all frontier natural boundaries, but I venture to think this statement should be modified, and that it would be better to say that they are *often* the best natural boundaries. As is the case with rivers, they should not be adopted without full geographical knowledge. In mountainous districts, when the line of water-parting is sharply defined and difficult of access, it is undoubtedly, next to the sea, the best possible boundary; but it often happens, even in very mountainous countries, that the main line of water-parting is not very clearly defined, and, as stated by Sir Thomas Holdich, the highest and most important peaks are frequently not on this line. In such cases it would often be preferable to select other crest-lines, or lines connecting peaks in preference to the main watershed. Such selection can, of course, not be made without a good map, and intimate acquaintance with the country. In some more or less mountainous districts it will be found that most of the habitations and cultivated land are situated on the top of the principal ridges. There the watershed would be a most undesirable frontier, and in countries in which the main rivers rise on flat elevated plateaux, or in low ground, it often becomes almost impossible to determine on the ground the exact line of water-parting.

A good frontier should cause as little inconvenience to the people living along it as possible, and therefore what I may describe as local requirements should be taken into consideration. For instance, tribal districts should not be interfered with more than necessary, villages and towns should not be cut off from their water-supply, or garden ground, or cattle posts; or, again, a stream should not be adopted as a frontier if the only practicable road between two towns on the same side of it necessarily crosses in some portion of its distance to the other bank.

There is one form of frontier which Sir Thomas Holdich inveighs against, and which certainly, from the surveyor's point of view, is most objectionable: I refer to lines of latitude and longitude, or straight lines connecting two points, the astronomical co-ordinates of which are specified. They are difficult and expensive to lay out on the ground, and when marked out and beaconed, are often difficult to recognize, and take no heed of what I have referred to above as local requirements. With reference to this, I should like to bring very forcibly to your minds the fact that these very objectionable artificial lines are frequently forced on statesmen, either by the absence of information regarding the district through which a boundary has to be drawn, or by such information as may exist being unreliable. It is better to adopt such lines than to find afterwards that mountains, streams, or places which have been specified do not exist, or are far removed from where they were supposed to be.

Sir Thomas Holdich proposes that, in cases where accurate information does not exist, agreements with reference to boundaries should be postponed till a survey has been made, but I am afraid this would only be practicable to a very limited extent. When international boundary questions arise, the relations between the states concerned are not unfrequently somewhat strained, and it may be necessary to come to some settlement at once. Under such circumstances, a good solution of the difficulty would appear to be, in cases where there is doubt as to the accuracy of existing maps, to agree to certain natural frontier-lines, provided they be found after survey to fall within a specified limited zone. When the country is almost entirely unknown, the best course to pursue would probably be to specify certain latitudes or longitudes as guiding-lines, which should be liable to be replaced by natural boundaries, provided suitable ones, within certain limits, could subsequently be found agreeable to all the high contracting parties.

Mr. H. J. Mackinder: Sir Thomas Holdich has distinguished rather strongly between the academic and the practical aspects of geography. Possibly, in some countries where the universities are a little more academic than in England, we might have to draw such a line strongly, but it is one of the ordinary criticisms of Oxford and Cambridge, passed by foreign professors for instance, that they are too little academic and too strongly practical. To our ultra-practical English mind this may sound an extraordinary position, but when we reflect that it is the function of an English university not only to produce professors, but also India civil servants, home civil servants, members of Parliament, and even prime ministers, I think we may claim that English universities have practical as well as academic functions. It is just because of that practical side of university work in this country that I value most the geographical teaching which it is now proposed to extend from the comparatively humble basis of the past few years.

The possibility of using the peaks fixed by Colonel Tanner and others, was based on the fact that when the trigonometrical position of a point is set down, there is no possibility of doubting the meaning of the observer. If language were used with similar precision, if such terms as "foot of mountains" and "easterly direction," to which Sir Thomas Holdich referred, were used with undoubted precision by all those talking on geographical matters, then it would be possible to refer with similar correctness to statements in language, and not merely in mathematical symbols. It is one of the results of academic training that language is used with precision. If for that reason alone, I venture to hope we may obtain something of practical value even from the academic study of geography.

We all of us thank Sir Thomas Holdich exceedingly for drawing attention to this matter, and if I ask him to soften a little the frontier which he draws between the academic and the practical, I know that he will be the first to agree with my general ideas.

The PRESIDENT: Before asking you to pass a vote of thanks to Sir Thomas Holdich, I think I ought to refer to the matter to which he alluded; perhaps I ought to have mentioned it at the beginning of the meeting, namely, the arrangements that we have been making with the University of Oxford to establish a really useful and practical school of geography in this country. In the preliminary negotiations to secure that end, we have had the very great advantage of advice and assistance from Sir Thomas Holdich himself, and I am glad to say that I can now announce to the Society that our Council this afternoon passed resolutions which enabled me to tell the Vice-Chancellor of Oxford that the authorities there are in full and perfect accord, in the arrangement of a scheme for a school of geography, with the Council of this Society. We now have every hope of establishing such a useful and practical school as will, in the time to come, if not immediately, dispel that ignorance which has in former times cost us so very dear. We would also—for it is the duty of the Council of this Society to tackle all difficult geographical questions—attempt to sweep away that habit of incorrect definition and of absence of definition which has also cost us so dear. We have appointed a committee in order to define the meanings of geographical terms, and give to every feature and every fact in nature connected with geography its right name. It will be a difficult task, and the result perhaps will not be immediately adopted, but I cannot help thinking it will be a useful task, and I am quite sure we were bound in duty as a Society to attempt it. In that way we hope we shall remedy two great defects which have been pointed out to us by Sir Thomas Holdich—the ignorance of geography in this country, and the absence of clear ideas with regard to the meaning of geographical terms. We have the great advantage of Sir Thomas Holdich's counsel, the counsel of a man with the experience of many years of geographical work in the field, and able by his learning as well as by his practical knowledge to give us most valuable advice. I now propose to you a cordial and unanimous vote of thanks to Sir Thomas Holdich for his most interesting and suggestive paper this evening.

EXPLORATIONS IN ICELAND DURING THE YEARS 1881-98.*

By Dr. TH. THORODDSEN.

As I have previously observed, the lowlands occupy but an insignificant extent of the surface as compared with the plateau.

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* Continued from p. 274. Map, p. 576.

Setting aside certain relatively broad throats of valleys and certain river-deltas, the east and north of the island possess no lowland tracks. The only quarter in which there are lowlands properly deserving of the name is in the south and south-west of Iceland. Between Hornafjord and Mýrdalsjökull there is a narrow but perfectly flat strip of coast, formed of fluvial detritus brought down by the almost innumerable *jökull* (glacier) streams, which break forth from the clefts and glens of the plateau. These countless anastomosing glacial streams roll down great quantities of gravel to the plains, and wherever the surface of the earth is inundated by the icy-cold glacier water vegetation refuses to grow. All along the southern border of Vatnajökull the farms are confined to a few oases, widely separated from one another by wastes of barren sand and furious glacial torrents. Indeed, in many places the people have been obliged to move their dwellings higher up on the mountain-sides, in order to escape the inundations caused by the ungovernable glacial rivers. Glaciers appear in every glen, and often thrust themselves close up to the very walls of the homestead. In the county of Vester Skaptafell, the ice-mountains recede from the coast, giving room for broader belts of lowland; but there too the lowlands consist of sandy deserts and fields of lava, the latter having issued from the craters of the interior. These lowland tracts are for the most part thickly strewn with rolled fluvial gravels and sand; but at the foot of the volcano Katla the gravel is mingled with volcanic ashes and scoriæ, which imparts a different character to the landscape. Extensive areas of drift-sand are also tolerably numerous. They produce large crops of sandwort, *Elymus arenarius*, the seeds of which are gathered by the poverty-stricken inhabitants and used for both bread and porridge.

This coast (the southern) is destitute of harbours, all the fjords having been gradually filled up by the detritus carried down by the glacial torrents. The sea, too, is so shallow that it is extremely perilous for ships to approach near to land. Besides, a heavy surf rolls in towards the shore, frequently with such violence as to dam back the glacial torrents, so that in this way a string of lagoons are formed. When the wind blows straight off the sea towards the coast, the outflow channels of the lagoons are often temporarily closed, and the rivers, being unable to discharge their waters into the sea, overflow the adjacent regions.

The largest continuous tract of level country in Iceland, a tract some 1550 square miles in extent, lies between the peninsula of Reykjanes and Eyjafjallajökull. My geological investigations have shown that this relatively low region is an area of subsidence bounded by faults reaching down to the foundations of the mountains. Here there have been constant changes going on all through the historical period, often taking the form of violent earthquakes, which more than once have occasioned serious loss of life and property. The mountains which shut in this lowland plain are composed of tuff and breccia. In most places they present an abrupt escarpment to it, and everywhere exhibit unmistakable evidences of volcanic activity. Its elevation is but little higher than the sea-level, but the plain rises uniformly towards the interior, ramifying in some directions into deep narrow glens. Its maximum elevation does not exceed 400 feet, and occurs near the geysirs. West of Mount Heckla the lowland plain merges almost imperceptibly into the plateau, there being no barrier breaking the level slope which unites the two—an unfortunate thing for the inhabitants of the cultivated lowlands, since the pumice-dust and drift-sand blow down upon them unchecked. During the north-east gales the inhabited lowlands suffer considerably; indeed, more than once in the course of time whole districts have been rendered uninhabitable, as, for example, in 1836 and 1881. This lowland region is, for the greater part, grass-grown, and, being well adapted for the feeding of live-stock, is the thickest-peopled of any districts in Iceland. At the close of the Glacial period it was entirely covered by the sea. In places where the streams have laid bare the lower strata, the shells of numerous arctic bivalves have been found in the clay; occasionally, too, parts of the skeletons of whales come to light. At a later period, after the lowlands were raised above the permanent level of the sea, they were overflowed by a great number of gigantic lava-currents, which came down from the volcanoes on the plateau or from those along its borders. The largest currents issued from Mount Heckla and from the volcanoes at Fiskivötn. In many places, therefore, the lavas lie underneath the more recent humus.

There is also a stretch of low ground, extending to some 400 square miles, but not more than 100 feet above the level of the sea, around the head of the broad bay of Faxaflói. It is partly enclosed by a semicircle of steep basalt mountains rising to 1500 feet, and penetrated by several valleys of erosion. The surface here is broken by a great number of marshes and moors, intersected by low ridges of basalt, which are sometimes bare rock, sometimes overgrown with scrub, but which all alike show evidences of glacial scouring. This district, too, was covered by the sea in Glacial times, judging from the strata of clay and their interbedded remains of *Yoldia arctica* and other shells, and from several other indications that the sea once rose to a permanently higher level than it does now. Here again we have an area of subsidence; for the deposits of lignite, which crop out at a considerable elevation in the encircling mountains, show themselves, in consequence of the faultage, at a very much lower altitude in the basalt ridges. Chains of craters with an abundance of warm springs form a semicircle round the little plain. The fissures from which the springs generally issue run diagonally across the entrances of the glens or valleys. In fact, the plain would appear to owe its origin to a *kesselbruch*, or the breaking down of the side of a basin, a phenomenon of which there are several instances in Iceland.

Iceland possesses numerous lakes, though the majority of them are of small size. The largest are Thingvallavatn and Thorisvatn, each slightly exceeding an area of 25 square miles. But the island possesses inexhaustible reservoirs of water in its numerous large glaciers. Indeed, all the largest of the lakes and rivers are fed directly or indirectly from glacier sources. The lake-basins owe their origins to various causes. Some are due to volcanic, some to glacial energy. Others, again, such as Mývatn, which is only from 6 to 23 feet deep, are merely depressions in the natural currents of the lava. This particular sheet of water, moreover, is studded with several craters, which project above its surface like islands; and all its immediate surroundings bear witness to great volcanic activity. A part of its supply is derived from springs in the lava. The group of lakes called Fiskivötn, west of Vatnajökull, consists for the most part of crater lakes. Between them and Vatnajökull stretches a wide lava waste, through which the water that melts off the glaciers filters till it reaches the lakes. Thingvallavatn is partly a lava lake, partly a glacial basin. Its southern portion is deep (about 425 feet), its northern portion shallower, and here the lake is bordered by currents of lava, which have flowed down between the great lava-fissures of Almannagjá and Hrafnagjá. The lake is also fed by subterranean affluents from the glaciers of Langjökull, whose water, after being filtered

AKUREYRI, ON THE NORTH COAST.

through the intervening lava-beds, issues from several fissures near Thingvellir as bright and clear as crystal. South of the lake there are unmistakable raised beaches, demonstrating that at one time Thingvallavatn must have been both larger and deeper than it is at the present time. The shrinkage in its area is principally due to the fact that its discharging stream, the Sog, has worn down its channel to a greater depth.

In many places on the plateau, where former large ground-moraines associated with low mounds have deposited their *débris*, numerous lakes are found. One such example is the large group of lakes at Arnarvatn, north-west of Langjökull. Moraine lakes are also frequent in the valleys, as, for instance, Skriduvatn, in the east of the island, Flód, in Vatnsdal, on the north side; and there are several others. In some districts you find deep basins scooped out of the basalts. Skorradalsvatn, with a depth of 125 feet, is one instance; another is Lagarfljót, a lake some 25 miles long, whose surface lies at an elevation of 85 feet above sea-level, whilst its bottom goes down to 275 feet below the level of the sea. Yet another category of lakes owe their origin to the damming up of jökel (ice-mountain) streams in the lowlands. These lakes are extremely shallow, and frequently alter their shape and size; for example, the newly formed Dyngjuvatn, south of Askja. Large pools of water, caused by the melting of glacial ice and snow, are frequent along the edges of the glaciers. Hvítárvatn, near Langjökull, washes the foot of two glaciers, from which icebergs are "calved" and float about on its surface. Although at the present time very shallow, 25 to 40 feet, this lake was formerly very much deeper, a fact proved by the existence of four separate raised beaches, one above the other, plainly marked on the sides of the nearest mountains. The highest level was coincident with the close of the Glacial epoch, when the lake was fenced in by glaciers on the south as well. Langisjór, a lake 14 miles long, by ½ to 1¼ mile broad, wedged in between two sharply pitched mountain chains, on the west margin of Vatnajökull, is also a dammed-up glacier lake. Although vegetation does not thrive, the surroundings possess a certain wild romantic beauty of their own.

In many parts of the island there are numerous coast lagoons, but more especially on the north side, where are Hóp, Höfdavatn, and Miklavatn. The quality of the water in these lagoons, whether fresh, stagnant, or salt, depends upon the results of marine erosion and upon the nature of the outlet. The fauna of these coast pools is consequently liable to change. Sometimes salt-water species have free access into them; at other times the salt-water species disappear or become extinct, and fresh-water species predominate.

Iceland possesses several rivers of considerable size, their volume being due to the moist climate and the great number of glaciers. The Icelanders are wont to discriminate between "mountain water," which is clear, and "jökel, or glacier water," which is of a milky-white colour. Taking the whole of the island into account, the glacier streams greatly preponderate. They vary in colour from a light milky-white to a rich chocolate-brown, according to the proportion of glacial clays which they hold in suspension. The other determining factors are the relative quantity of "mountain water" they contain, their nearness to the glaciers, and the greater or less degree of glacial melting consequent upon the changes of temperature. Owing to these same causes the colour of the glacial streams varies also according to the seasons. In some short glacial streams the colour even changes in close accord with the varying warmth of the night and the day. But, as a rule, all the larger glacial rivers are tinged with colour all the year round. There is no place in Iceland where the peculiarities of the glacier streams can be so well studied as in the coast districts south of Vatnajökull. In that region innumerable *jökel* streams, most of them short, torrential, variable in

HALLORMSTADASKOGUR, IN EAST ICELAND: THE HIGHEST BIRCH TREES IN THE ISLAND, 28 FEET.

their courses, run down to the coast, to such an extent that clear water is almost unknown. In summer many of these glacial torrents spread out to such a great width, that it takes a good hour or two to ride across them. A large proportion of this time, however, is consumed in making *détours*, in order to escape the violence of the current and its deeper reaches. There are probably few places in the world where one can at the present day study under more favourable circumstances the geological conditions which prevailed towards the close of the Glacial epoch in Europe. In the regions of the flat sand the rivers are constantly changing their beds, sometimes more than once in the course of a single day; for their volume varies directly with the rate of melting of the glaciers. In the winter many of them shrink to a minute fraction of their summer volume. All the glacier streams possess the common characteristics of carrying down large quantities of pebbles and clay, and of spreading out over the lowlands in a network of anastomosing channels. Generally they emerge from their parent glaciers with a pretty steep fall, and gather heavy burdens of pebbles and *débris* from the moraines—so heavy, indeed, that when the strength of the current diminishes, the stream cannot carry its load, but drops it. The river-bed thus gets choked up; the current divides. The strongest branches force their way through the *débris*, encounter fresh obstacles, run into one another, coalesce with other branches, gain accessions of power, once more burst through the deposits of gravel, send off small side arms, again diminish in volume, and so go through the whole process afresh. Thus there is an unceasing struggle between the glacial torrents and the masses of gravelly *débris*, giving rise to an incessantly changing network of interconnected channels. One day a river branch will be swollen to the dimensions of a dangerous river; the next day it will contract to the compass of an insignificant rivulet. A minute often suffices to cause a stoppage, a division of the current, the carving out of a new bed. Some of these streams become dammed up till they form lakes, which overflow and inundate many square miles of the adjacent country. Some cut out such deep channels through the glacial *débris*, that they do not shift their courses for many years. One of these glacial torrents, therefore, often presents a picture of an extremely complicated network of hundreds of branches, enclosing between them a multitude of islands of clay and sand, which are equally as variable as the rivers themselves. It may be accepted as an invariable law, with regard to the glacial streams of Iceland, that they never empty themselves into the deep fjords. In all cases where they formerly did so, the fjords have become choked with sand, gravel, and clays. There are, however, a few places where the process of filling up a fjord is still actively going on; for instance, Borgarfjord, on the west coast, which receives the (river) Hvítá. Although this stream brings down a relatively small quantity of glacial clay, nevertheless during the last eight hundred or nine hundred years it has levelled up the fjord to such an extent that, whereas in ancient times large trading-ships sailed up it without difficulty, at the present day small boats can only get up at the times of high water.

As I have already said, where the interior plateau is composed of palagonitic tuff and breccia, it slopes evenly down towards the sea—a circumstance which is not without its effect upon the direction of the longest and greatest rivers of the island. The Œlfusá, the Thjorsá, and the Markarfljót, all streams of considerable magnitude, flow down the natural slope of the plateau towards the south-west and the south. The Markarfljót divides and reunites many times before it empties itself into the sea, thus forming the largest delta (Landeyjar) in all Iceland. The Thjorsá, 125 miles long, is the longest river in the island. On the north side of the island nearly all the rivers flow due north. The largest stream on that side is the Jökulsá, which enters Axarfjord. The largest and longest glacier streams of the plateau originate at altitudes of 2000 to 3000 feet, these being the limits of altitude of the glaciers themselves. But although the rivers of Iceland carry down relatively heavy floods of water, they are not navigable; chiefly by reason of their steep fall, their torrential current, their tendency to spread out and subdivide into numerous branches in the lowlands.

Waterfalls are tolerably plentiful. The most important is Dettifoss, in the Jökulsá. The river plunges down a fall of 350 feet vertical height into a chasm some 12 miles long, which in all probability was originally a volcanic fissure. Many other waterfalls, some of them high, some of them picturesque, some of them uniting both characteristics, exist in different parts of the island. The best known are Skógafoss and Gullfoss in the south, Hengifoss in the east, and Dynjandi in the west. As an almost invariable rule, the larger waterfalls occur in places where tuff formations are overlain by basalt or dolerite; the upper rocks, getting undermined, break off and topple down.

The principal petrological constituents of Iceland are basalt and palagonitic breccias. Compared with these two formations, all other varieties of rock are excessively poorly represented. Nearly two-thirds of the entire area is basalt; palagonitic breccias occupy nearly the whole of the remaining one-third. The palagonitic breccias, which are of younger formation than the basalt, stretch in an irregular belt diagonally across the island.

The north, north-west, and east coasts are everywhere modelled on grand proportions, their profiles reaching from the top to the bottom of the basalt formation, in the same way as in the Færoe islands, except that the outlines are more imposing. The mountains front the ocean like cyclopean walls, towering up in some places to more than 3000 feet above its surface, the basalt being disposed in layers one above another in varying degrees of thickness. Not that they are universally horizontal, for now and again a layer is wedged in between two others, in such a way that its thickness rapidly decreases the further it goes inland; and after a very short distance it disappears entirely, whilst its place is taken by another layer. A few small deposits of tuff and breccia occur interspersed among the basalt. Dykes are frequent; most of them pierce down through the entire series of strata. The basalt formation certainly extends to a total thickness of at least 10,000 feet, in all probability to a good deal more. So far as is known, the underlying sedimentary rocks do not crop out in a single locality throughout the whole of the island.

Seen from a distance, the basalt mountains have a monotonous and gloomy appearance; but a closer examination reveals tolerably wide divergence in the details. Some of the basalt layers are close-grained: others are coarse-grained and crystalline,—doleritic, porphyritic, scoriaceous, banded, amygdaloid; the last containing vesicular cavities more or less filled with such concretions as zeolites, quartz, calcedony, calc-spar, and so forth. In some districts the basalt is cleft into handsome columns; in others, into sharp-edged blocks of irregular shape; in others it presents a lamellated appearance. There are certain localities where olivine so greatly preponderates, that the basalt layers seem to consist almost entirely of this mineral. In other localities, again —for example, in Hrappsey*—I have found masses of almost pure anorthite embedded in the basalt. Iceland spar is distributed through a network of crevices in the basalt at Helgustadir, in the east of Iceland, and at Djúpidalur, in the west.† Numerous well-preserved fossilized plants, discovered in the basalt in several places on the west and north-west of the island, prove that the basalt is coeval in age with the Tertiary period. The fossiliferous layers occur about midway up in the vertical faces of the basalt, so far as they are visible in the fjords of the north-west peninsula. I have there traced most of them through their various levels; for, although originally deposited at the same horizontal level, they have subsequently been several times dislocated, and now exist at different elevations and at different angles. The tree-stems have been pressed flat. In that condition they are called by the Icelanders *surtarbrandur;* and this name is a convenient name to use for the whole of the Icelandic lignite strata. Hence we call them the "Surtarbrand formation." This formation is from 60 to 100 feet thick, and consists of diversely coloured strata of clay and tuff, intercalated with strata of lignite, surtarbrand, carbonaceous slates, etc. Leaf impressions occur in the white and grey clays, sometimes also in clay pans of a reddish or greenish colour. Vegetable fossils are best preserved at

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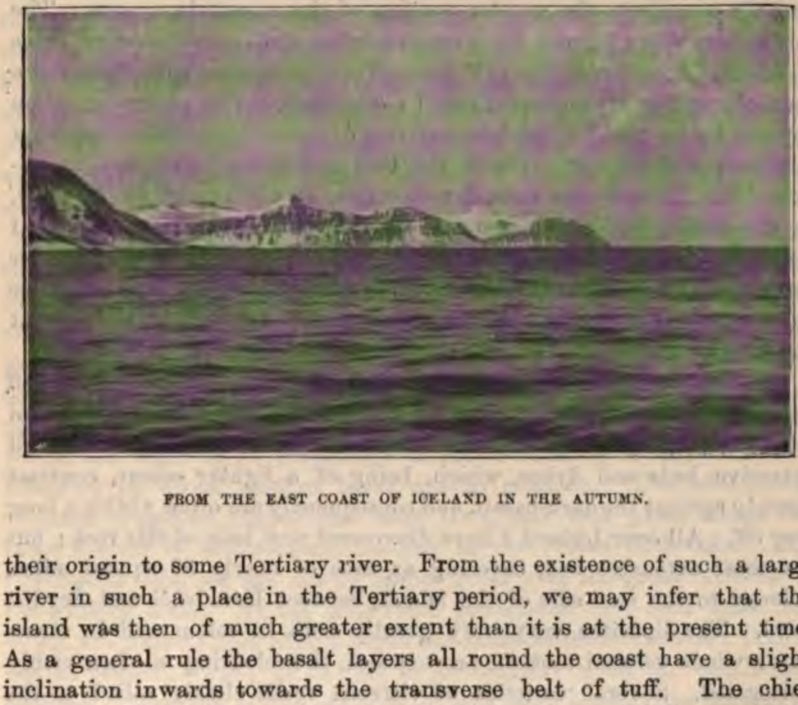
* "Geologiske Iagttagelser paa Snæfellsnes," p. 15.

† "Einige Bemerkungen über die Fundorte des isländischen Doppelspathes," in *Himmel und Erde*, iii. pp. 182-187 (Berlin, 1891).

Brjámslækur, Tröllatunga, and other localities around Steingrimsfjord. The extensive forests which formerly grew in Iceland seem in some districts to have been overwhelmed by pumice ashes, in others by currents of lava. Pieces of the stems of trees are occasionally discovered in the scoriaceous crust of the lava. Silicated tree-trunks are not at all uncommon.* At the period when the surtarbrand and lignite strata were deposited, it is certain there were many marshes and small lakes scattered over the surface of the country; and it is equally certain that there were several rivers of pretty large size, because in certain localities—Leirufjord, for instance—there now exist considerable formations of conglomerates intermixed with sand and rolled gravel, to a thickness of more than 300 feet, which, it is reasonable to suppose, owe their origin to some Tertiary river. From the existence of such a large river in such a place in the Tertiary period, we may infer that the island was then of much greater extent than it is at the present time. As a general rule the basalt layers all round the coast have a slight inclination inwards towards the transverse belt of tuff. The chief local exceptions to this rule are due to dislocations; this is especially true of the north-west peninsula, which is cleft right through by several semicircular faults. In a few isolated places the basalt mountains are



FROM THE EAST COAST OF ICELAND IN THE AUTUMN.

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* "Surtarbrandens geologiske Forhold i det nordvestlige Island," *Geolog. Fören. Förhandlingar*, xviii. pp. 114–154 (Stockholm, 1896). In this paper I have described every locality in north-west Iceland in which surtarbrand has hitherto been discovered, and given profiles, maps, etc. The well-known palæontologist, Prof. A. G. Nathorst, of Stockholm, has kindly consented to examine and identify my collections of fossilized Icelandic plants.

built up of horizontal layers, standing out like a *horst*, or upstanding table, the surrounding country having subsided.

The tuff formation, which extends transversely across the island, belongs to a later period than the basalt. The appearance and composition of its constituent rocks differ greatly in different localities. The prevalent colours are various shades of brown. The tuff occurs partly in masses of fine-grained texture and yellowish-brown colour, partly in the form of breccias. The fragments, which are of widely different sizes, consist of compact basalt, dolerite, pumice, scoriaceous lava, volcanic "bombs," or large round stones ejected by the active volcanoes. The separate fragments are very often covered with a crust of tachylyte. In addition to these, tachylyte and fine-grained palagonite are of general occurrence everywhere; in fact, they frequently constitute the greater portion of the mountain masses. The tuff is very often pierced by intrusive dykes and many-branched veins of basalt. Sometimes the tuff is arranged in layers; sometimes not a trace of regular arrangement can be discerned. The entire formation appears to be made up of two separate divisions—one older, the other younger; and in many places the two varieties of rock are unconformable. This is the case, for example, at Œlfus and at Hafursey. In the desert region between the Skaptá and the Tungná (rivers), I discovered masses of tuff 1000 to 1300 feet thick, resting upon an older deposit of ice-scoured breccias. I am inclined to think that these more recent post-glacial tuffs are pretty widely distributed throughout the interior plateau.

In many places all over the island, in both the basalt and the tuff formations, although in relatively insignificant proportions as compared with them both, there occur small beds of liparite. It exists in small intrusive beds and dykes, which, being of a lighter colour, contrast sharply against the dark basalt, and consequently are often visible a long way off. All over Iceland I have discovered new beds of this rock; but the most extensive bed, covering an area of nearly 50 square miles, belongs to the east side of the island, between Héradsflói and Seydisfjord. The liparites vary very greatly both in colour and in structure; where vertical sections are exposed, the colouring is often richly variegated. Several varieties of vitreous rocks closely allied to the liparite, most frequently pitch-stone, generally occur in close association with it. A large proportion of the liparites have been metamorphosed by fumaroles. The places where such changes have taken place offer splendid opportunities to study the chemical disintegration and decomposition of the different varieties of rocks and minerals.* In the south-east of the island—for example, in Breiddalur, Lón, and Hornafjördur, as well as at Máfahlid in Snæfellsnes—I discovered granophyr in veins and intrusive dykes in the basalt. A large dyke of this igneous stone, overlain with basalt and interpenetrating it in a large number of articulated veins, occurs in the Slaufrudalur at Lón. In the same district, on each side of the Bay of Lón, there are two large and imposing peaks of gabbro, capped with basalt and seamed with veins of liparite and granophyr. The glacial streams which flow from the glaciers of Vatnajökull, also carry rolled pebbles of gabbro down to the lowlands. Possibly there are mountain masses of this rock buried under the *névés* of Vatnajökull.

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* I have described the several occurrences of liparite in numerous papers and accounts of my journeys. Some specimens have been examined petrographically by H. Bäckström, who has published the results in "Beiträge zur Kenntniss der isländischen Liparite," in *Geolog. Fören. Forhandl.*, xiii. (Stockholm, 1891).

In a single locality in the north of Iceland, namely, at Tjörnes near Husavík, I have met with extensive beds of shelly sand belonging to the Red Crag division of the Pliocene formation. Its situation points to a level of the sea some 150 or 200 feet higher than the existing level. In the vicinity there exist also deposits of surtarbrand, but unfortunately no leaf-impressions or other distinctive fossil remains of plant-life. The fossils* were identified in 1871 by O. A. L. Mörch, and, according to Gwyn Jeffrey, there are several American species amongst them.

In the year 1865, the Swedish geologist Paijkull called attention to the fact that the dolerites of Reykjavik had precisely the same structure as lava, and exhibited plain indications of glacial scouring; in other words, they were lava which had been ejected during or prior to the Glacial epoch. In my later journeys I ascertained that these doleritic lavas have a very large distribution in the west and south and north of Iceland. They are more especially associated with the districts which are built up of palagonitic breccias—that is to say, with the localities in which modern lavas are so common. The pre-Glacial volcanic eruptions obeyed the same laws, and took place along the same system of architectonic fissures, as the recent outbreaks. The pre-Glacial dolerites are mostly found underlying the great outflows of the modern lavas. At the time these pre-Glacial lava-beds were laid down, the country had pretty much the same essential contours that it has at present. They often rest unconformably upon the basalt and breccias. Like the recent outflows of lava, they issued from fissures in the earth, along which chains of craters were formed, and in some isolated places cones of lava. But all these older craters have disappeared, having been swept away by the glaciers of the Glacial epoch. I only know of a single locality in which a unique specimen of a well-preserved pre-Glacial crater still remains, and that is on the summit of the mountain Bláfjall, 4020 feet high, which stands south of Mývatn. The glacial striations on the side of the mountain prove that during the Glacial epoch the highest portions, together with the ancient crater, projected like a *nunatak*, or island of bare rock, above the inland plain of ice. Thus the dolerites on the top of Bláfjall have preserved their superficial lava-like structure unchanged; whereas the mountain of Sellandafjall, in the same immediate neighbourhood, rising to a height of only 3285 feet, has been scoured by the Glacial ice.

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* The collections of specimens which I made in that locality are not yet identified. The fossils which I collected in 1884 are preserved in the museum of the Academy of Sciences at Stockholm. Those which I gathered when with Johnstrup, in 1876, went to the Mineralogical Museum of Copenhagen.

Pre-Glacial lava-cones, with a crater opening on the top, exist in many parts of the island. They have but a slight inclination of two or three degrees, and closely resemble the more recent lava-cones, except that their superficial crusts of scoriæ have been scaled off, and the cones scoured by ice. In very many places these pre-Glacial lavas attain to a thickness of from 300 to 600 feet, and even more; and in all probability they are as widely distributed as the recent lava-streams. Some of the larger volcanoes of Iceland—for instance, Eyjafjallajökull, Œræfajökull, Snæfellsjökull—which have been in eruption within historic times, were also active prior to the Glacial epoch.

In many places of the west and the south I have discovered large deposits of pre-Glacial conglomerates, mingled with rolled gravel and sand, which seem to be analogous to the *nagelfluh* of the Alps. In some localities they appear to have been the first strata laid down after the excavation of the valleys; in others the contour of the ground seems to have been considerably changed since that period, especially by subsidence. A closer investigation will probably demonstrate that these conglomerate strata belong to different epochs. The presence of such large quantities of rolled gravel points in all probability to the action of rivers with a powerful current existing at a time when the precipitation was unusually heavy. Indications of a period of heavy rainfall, like that here supposed to have occurred just previous to the Glacial epoch, have been observed in other countries—for instance, Switzerland and America.

During the Glacial epoch the whole of Iceland was wrapped with a thick sheet of inland ice, through which only a small number of peaks projected here and there near its edges. At the time the ice-sheet was broadest and thickest, there can be little doubt that the *jökler* (ice-mountains) of the interior spread out their arms in every direction. The lateral and terminal moraines, however, which still remain in the valleys, date from a later period, after the ice had begun to retire. The north-west peninsula was in all probability covered by a separate ice-sheet, which sent numerous smaller glaciers with bare ridges between them down to the sea. In that part of the island ancient lateral and terminal moraines are much commoner than in the main part of Iceland. There, too, as in so many other districts, the moraine deposits have been greatly altered by the action of the sea in the course of its advance at the expense of the land. The ice-sheet which covered the interior plateau during the Glacial epoch was at least 2500 feet thick; on the north-west peninsula it was 1500 feet thick. Its outward slope, like that of the existing ice-sheet of Greenland, was relatively insignificant and tolerably even. From Vatnajökull to the north coast it can scarcely have been greater than 0° 37′.

Glacial scourings are found all over the island, on every variety of rock which is older than the Glacial epoch—up on the plateau, down in the glens and valleys, on the lowland plains. I have measured the direction of the striations in more than two hundred places, and without exception all radiate outwards from the centre of the island towards the coasts.* In several localities on the lowlands I have observed instances of intersecting striations. From this we may conclude that those districts have experienced more than one glaciation; but the observations are still too incomplete to warrant, with anything like safety, the deduction that Iceland has been visited by more than one Glacial period. The broad bays of Breidifjord and Faxaflói were both formed prior to the Glacial epoch, and both received glaciers from the mountain chain which traversed the peninsula of Snæfellsnes between them. On the whole, my geological investigations prove that the general structure and contour-lines of Iceland were in all respects essentially the same before the Glacial epoch that they are to-day. The disposition of the strata show plainly that the doleritic pre-glacial

THE VOLCANO SNÆFELLSJÖKULL.

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* In 1891 I published in *Geogr. Tidskrift*, xi. plate ii., a map showing the direction of the glacial striations; but since then I have observed a great number of other instances in different parts of the island.

lavas, of which I have already spoken, are not of Tertiary age, but were ejected and laid down after the island had assumed the broad general characteristics of form and appearance that it now has, and show also that they rest unconformably upon the basalt and palagonitic breccias. South of Esja, on the east side of Faxaflói, the pre-Glacial lava-streams have flowed down the slope from the plateau, and filled up the valleys and depressions between the ranges of basalt and breccia. The same thing may be observed in the Hnappadalur, in Snæfellsnes, the Flokadalur, and several other districts. Now all these doleritic lavas exhibit unmistakable evidences of glacial scouring, so that they must be older and anterior to the Glacial epoch, and the depressions and valleys through which they have flowed must be older still.

Hundreds and thousands of large erratic blocks are scattered all over Iceland; but they afford no data of a reliable character for determining the distribution and movement of the jökler of the Glacial epoch, for the similarity of structure common to the mountain rocks throughout wide regions often make it impossible to determine the original provenance of the boulders. Nevertheless, boulders are often met with which have a different petrological composition from the rocks they rest upon; and a close examination of the local conditions frequently affords pretty safe indications for inferring this or that as to the movements of the glaciers during the Glacial epoch.

Signs of the coast-line having receded since the Glacial epoch are very common all round the coasts of Iceland, but nowhere are they so common or so well developed as in the north-western peninsula. Every part of the cliff-bound coast bears indications of pebbly marine terraces, coast-lines, surf beaches marked on the solid rock. In many places remains of shells have been found, sometimes also parts of the skeletons of whales and walruses, as well as ancient drift-timber, at considerable distances from the present line of coast. Round the north-western peninsula there are plain, well-developed coast-lines or raised beaches, and surf-beaches at two distinct levels—one at about 250 feet, the other at about half that height above the present sea-level. The same phenomenon of a double beach occurs on other parts of the coast. The lower of the two is visible all round the island; the upper is more seldom present, as well as less clearly marked. Caves, hollowed out by the surf when the sea was at a permanently higher level than it is now, are pretty general on the south coast. As I have already observed, towards the close of the Glacial epoch the lowlands were overflowed by the sea, which also penetrated some distance up the valleys in many places on the north and east of the island. In the south-west of Iceland there exist important argillaceous strata containing *Yoldia arctica* and other arctic bivalves at an elevation corresponding to the higher of the two ancient sea-beaches which I have just mentioned. Other mounds of shells, belonging to a fauna which resembles that now existing in Iceland, occur at elevations answering to the lower of the two ancient sea-beaches. The species *Saxicava* is especially characteristic of these mounds of shells. The coast has been steadily and constantly receding ever since the Glacial epoch, and the movement appears to be still going on, although at such a slow rate that it has never been actually measured.*

At the present time the *jökler* of Iceland cover an area of 5170 square miles. The climate of the island is peculiarly suited for the development of large glaciers, the atmosphere being raw and cold and moist, the precipitation plentiful, and the amount of summer warmth but small. The precipitation is, however, very different in different parts of the island—for instance, in Berufjord, in the south-east, the annual rainfall amounts to 42½ inches; at Stykkisholm, in the west, to 25½ inches; and on the island of Grimsey, off the north coast, to 16 inches. The precipitation is consequently heaviest on the south-east coast, and it is in that quarter of Iceland that the ice-clad mountain mass of Vatnajökull covers such a vast area of the plateau. In the south and south-west districts the weather is at all times very changeable and stormy. Snow seldom lies long in winter on the lowland plains. Frost and thaw alternate several times in the course of a single day. Indeed, it often happens that for months together in the winter there is not a particle of snow to be seen on the lowlands of the south. On the other hand, it rains very frequently; but whilst it rains on the lowlands, it is often at the same instant snowing heavily in the elevated interior. For a series of years I have taken observations at Reykjavik of the number of days during which the ground has been covered with snow. The period is much shorter than one would suppose. In the winter of 1889–90, snow lay on the ground only ninety-six days; in 1890–91, only eighty-four days; in 1894–95, not more than fifty-six days. In the north of the island, on the contrary, snow lies for a very much longer period. From observations made on the coast, it would appear that the climate of Iceland is typically insular, the winters being relatively mild, and the summers cool. Up on the plateau there is unquestionably a much greater difference between the winter mean and the summer mean; but, unfortunately, we possess no data from that region. In the subjoined table, which was worked out at the Meteorological Institute in Copenhagen, I give observations taken at only one station on the plateau, namely Mödrudalur, which lies at an elevation of 1640 feet above the sea. As a single glance will show, the temperature there has a much greater range than at the other stations.

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* "Post-glaciale marine Aflejringer, Kystterrasser, og Strandlinjer i Island," in *Geogr. Tidskr.*, xi. pp. 209–225, with a map.

Mean Temperatures for the Period 1874–92; *the Readings being those of the* Centigrade *Scale.*

Name of station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Stykkisholm (W. Iceland)	−2·2	−2·6	−2·5	0·8	4·1	7·9	9·7	9·2	7·2	3·8	0·7	−1·7	2·9
Eyrarbakki (S. Iceland)	−2·2	−1·6	−1·8	2·3	5·8	9·2	11·1	10·3	7·4	3·4	−0·2	−2·3	3·5
Berufjord (E. Iceland) ...	−1·6	−1·4	−2·2	1·0	3·6	6·7	8·3	7·9	6·4	3·3	0·8	−1·2	2·6
Akureyri (N. Iceland) ...	−3·7	−3·5	−3·8	0·6	4·2	8·8	9·9	9·0	6·7	2·2	−1·3	−3·3	2·7
Vestmannaeyjar (off S. coast)	1·0	1·3	1·2	3·9	6·4	8·7	10·6	9·9	7·8	5·1	2·7	0·9	5·0
Mödrudalur (on plateau)	−8·1	−6·8	−7·8	2·4	2·1	8·3	9·2	6·9	3·7	−1·3	−5·1	−7·7	−0·3

The temperature of Iceland varies very greatly from year to year, and also the mean of the separate months. For instance, take the month of March: at Stykkisholm the highest mean in a period of thirty-eight years was 4·3° C. (39·7° Fahr.); the lowest mean in the same period, −13·3° C. (8·1° Fahr.). This excessive variability in the temperature exercises great influence, not only upon the quantity of the snow which falls, but also upon the altitude of the snow-line, to say nothing of the injurious effects it has upon the food-supplies of the people. The factor which exercises the greatest influence of all upon the climate is well known to be the Greenland drift-ice. When the ice appears off the north coast, the temperature immediately falls. In May and June, when the people who dwell in the south of the island perceive that it is snowing on the mountains, they at once take it as a sign that the dreaded drift-ice is about to invest the north coast. During the nineteenth century that coast has been free from ice about one year in every four or five.* So long as the ice drifts backwards and forwards along the coast, the weather continues to be very changeable and stormy; but once the ice gets set fast to the land, the weather becomes more settled, though colder. The parts of the coast which are most subject to be blocked by the drift-ice are the north and east sides of the north-west peninsula (county of Strandir), and Langanes and Melrakkaslétta, at the north-east corner of the island. The effects of the presence of the drift-ice in those regions are manifested both in the greater extension of the snow-wreaths and in the character of the vegetation. Owing to the constant coldness of the springs and the rawness of the summers, vegetation is extremely stunted and poor.

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* *Vide* "Den grönländska Drifisen vid Island," in *Ymer*, pp. 145–160 (Stockholm, 1884). This paper contains all the information that I have been able to collect from Icelandic sources, published and unpublished, about the drift of the ice along the coast of Iceland, together with a table showing its range during the different months all through the nineteenth century. I have a series of important notes drawn from the Icelandic annals of different centuries, and dealing with the climatology and meteorological conditions of the island, which I have only in part arranged and worked up. As yet none of these results are published.

Before I began my investigations, there existed absolutely no observations of the height of the snow-line in Iceland. Accordingly I made it my special object to remedy the defect, by noting the snow-line in various districts, as well as the limits of the glaciers and their periodical changes. The accurate determination of the snow-line in Iceland is not at all easy, owing to the extreme variability in the climatic conditions. I have found it convenient to discriminate between three different boundary-lines for the vertical deposition of the snow, depending upon meteorological and orographical conditions. The snow-line, in the ordinary acceptation of the term, that is, the boundary-line marking the lowest edge of the snow which covers the mountains perpetually in one unbroken sheet, does not vary much from year to year. Below that, however, lies a belt of detached patches of snow, more or less closely packed together; these never thaw entirely, but increase and decrease according to the character of the year. Below this belt again stretches the skirt of the snowy mantle which is most changeable—scattered drifts of snow which are relatively dependent upon such orographical conditions as altitude, aspect, and so forth. It sometimes happens, that these drifts remain without melting for several years, if they are years characterized by cold and moist atmospheres; but if the seasons come warm or dry, they shrink to a minimum or even disappear entirely. I have only space to cite a single example. On the east side of Drangajökull, in the

THE RIVER HVÍTÁ, IN BORGARFJORD.

north-west peninsula, the snow-line runs at 1300 feet above sea-level; but on its west side it runs at 2100 feet. On the plateau itself, all around the base of the same mountain, at altitudes of 800 to 1300 feet, there are a vast number of detached snow-drifts, equal to an aggregate area of 70 or 80 square miles. But in the summer of 1886 I observed numerous patches of snow at an even lower level, and in sheltered spots quite close down on the edge of the sea. The same relative phenomena occur in several other parts of the island. The next table (p. 499) will show how the snow-line varies in different districts, the variations being principally due to the varying amount of the precipitation.

The great ice-mountains of Iceland are without exception closely associated with the interior plateau. Ice-sheets of great thickness and with an undulating surface, and *firn* (coarse, half-solidified snow), with a gentle inclination, cover extensive areas on the highest parts of the plateau. Isolated mountain peaks are rare. They are mostly ranged near the edge of the plateau, and very often are merely the outstanding summits of the underlying rocks. There is no gravel visible on the surface of these snow-fields. Gravel only appears at the ends of the glaciers, and they are often quite black with it and with fragments of rock. The great Icelandic *jökler* have a quite different appearance from the *firn* and ice-masses of the Alps. They resemble more nearly the type of glacier which is characteristic of the polar regions. Still, in some places along the borders of the plateau there are smaller glaciers which do present a somewhat similar appearance to the Alpine glaciers. In the Alps the *firn* basins are only of small area, but the glacier-streams, in comparison with them, extend to a relatively enormous length. In Iceland, on the contrary, the *firn* basins are of great extent, whilst the glacier flows are short; but at the same time they are often of considerable breadth, so that their resultant area is in many cases large. Several of the glaciers of Vatnajökull stretch over an enormous area. For instance, Dyngjujökull covers 155 square miles; Skaptárjökull, 195; Brúarjökull, 195, and so on. These, however, far exceed all other Icelandic glaciers in extent, being comparable to some of the Greenland glaciers. In fact, Vatnajökull might very well be regarded as a relatively small instance of inland ice-formation.

I have already stated that the aggregate area of the *jökler* of Iceland amounts to no less than 5500 square miles. The glaciers of Switzerland cover an aggregate area of 710 square miles; and those of the Alps throughout, from the one end to the other, slightly exceed 1160 square miles. The area covered by glacial ice in Norway is much about the same; that of Sweden, 155 square miles. Thus the only parts of the world in which there exist glaciers comparable in size to those of Iceland are the stupendous masses of ice in the polar regions. In this place I have not space to enter upon a detailed description of the individual glaciers of Iceland. I can only refer for particulars to my longer papers on the subject,* merely giving here a table in which the more salient data are succinctly recorded.† Of the older publications dealing with the glaciers of Iceland, the most complete, as well as the most accurate, is the paper by Sveinn Pálsson, written in the year 1794.

Names of glaciers.	Area in square miles.	Maximum height above sea-level in feet.	Absolute altitude of snow-line in feet.	Number of glaciers known	Altitude of inferior end in feet.
Gláma	90	2955	2130	—	—
Drangajökull	135	2920	—	7	—
„ east side	—	—	1310	—	100
„ west side	—	—	2130	—	80
Snæfellsjökull	10	4710	—	2	1640
„ north-east side	—	—	2725	—	—
„ north-west side	—	—	3280	—	—
Langjökull	500	4595	—	28	—
„ south-west side	—	—	2950	—	1970
„ east side	—	—	3280	—	1475
Eiriksjökull	40	5900	—	5	—
Ok	15	3900	—	—	—
Arnarfellsjökull	520	5250	—	15	—
„ south side	—	—	—	—	1810
„ north side	—	—	3935	—	2945
Mýrdalsjökull	385	5595	—	19	—
„ north side	—	—	3610	—	2300
„ south side	—	—	1970	—	165
Torfajökull	40	*c.* 4600	3115	—	—
Tindfjallajökull	10	—	—	2	—
Vatnajökull	3280	6425	—	33	—
„ west side	—	—	3280	—	2085
„ north side	—	—	4265	—	2510
„ south side	—	—	2000	—	30
Hofsjökull (south-east Iceland)	30	3610	—	1	1640
Thrandarjökull	25	3610	—	—	—
Snæfell	5	5980	—	2	—
Tungnáfellsjökull	385	*c.* 5250	—	2	—
Several small glaciers on the north and east of Iceland	75	3950 to 4250	—	8	—
Totals	5545	—	—	124	—

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* See "Islands Jökler i Fortid og Nutid," in *Geogr. Tidskrift*, xi. pp. 111–146, besides accounts of my several journeys in the same periodical, and in the Icelandic journal *Andvari*. My observations on the changes which Icelandic glaciers undergo have been worked up by M. Ch. Rabot, in a paper entitled "Les Variations de Longueur des Glaciers dans les Régions Arctiques et Boréales,' in *Archives des Sciences Physiques et Naturelles*, vol. iii. (Geneva, 1897). Compare also the same author's "Les Volcans et les Glaciers d'Islande d'après les Explorations de M. Thoroddsen," in *Nouvelles Géographiques*, 1894, pp. 97–103, 119–122.

† I published a similar table in *Geogr. Tidskrift*, 1891, and in *Petermanns Mitteilungen*, 1892. But since those dates I have examined a great number of additional glaciers, especially in the south-west and north of the island, so that the table which immediately follows is more complete than the former ones. For one thing, the number of glaciers, from which the data are drawn, has increased from seventy to one hundred and twelve.

Sometimes the volcanoes which are buried underneath the glaciers break out into eruption, bursting and melting the glacier above them, and giving rise to what is known as a "*jökel* flow," or in Icelandic *jökulhlaup*, a phenomenon peculiar to Iceland. When this happens, the broad beds of sand which lie at the foot of the *jökler* are inundated by a foaming flood of turbid water, with large fragments of ice tossing on its surface. And as the ice and the flood both carry with them inconceivable quantities of gravel and pieces of ruptured rock, these catastrophes sometimes cause serious alterations in the contour relations of the surrounding country. The volcano Katla has occasioned probably as great changes as any in Iceland in precisely this way; having completely filled up the fjord in the course of time, and very materially changed the coast-line. When this mountain was in eruption on May 11, 1721, such an enormous number of fragments of ice were shot out over the sea, that it was not possible to see across the floating ice-field even from the summits of the highest mountains in the neighbourhood. The biggest of the ejected bergs grounded 3½ miles from land, at a spot where the sea was 420 to 500 feet deep. At Höfdabrekkufjall the eruptive torrent was 350 feet deep, and at Hjörleifshöfdi, a rocky pinnacle 125 feet high was swept bodily away. During the outbreak of 1755 a ridge of gravel and ice, 12 miles long and 130 feet high, was left right across the Myrdalssandur. Œræfajökull, which is sheathed throughout in ice, has been in eruption several times. The most destructive outbreak occurred in the year 1350, when in the course of a single morning two parishes, embracing forty farm-steads, and two manses and their buildings, perished in a jökel flow. In the nineteenth century jökel flows have been frequent from Skeidarárjökull; they proceed, in all probability, from a volcano which lies buried under the snows of Vatnajökull. Minor jökel flows are also pretty common, caused by dammed-up rivers and small lakes in the glaciers periodically bursting their icy barriers, and inundating the lowlands.

Iceland ranks amongst the countries in which volcanic energy is most active, and the activity manifests itself under conditions which are especially interesting to geologists. For this reason, I made the investigation of the volcanoes an object of careful study throughout all my journeys. I have had the good fortune to visit every volcano in the island. Of these the greater part were previously unknown to geologists. I have drawn maps of most of them, but only a few of my maps are as yet published. In the relatively rich historic literature which Iceland possesses, we are fortunate enough to have numerous records of volcanic outbreaks in the island in both ancient and modern times. Most of these records exist in manuscripts preserved in the public libraries in Denmark and Iceland, and in private collections; but only a very few of them are as yet printed. All these accounts I compiled before beginning my exploring journeys, and digested them into a book in which I related the history of the Icelandic volcanoes.* Some day I hope to publish the original sources *in extenso*, having taken accurate copies of them. To describe all the volcanoes of Iceland, and relate their every eruption, in this present paper, would spin it out to an inordinate length. I must confine myself, therefore, to a brief general survey, referring for further particulars to my other publications.†

The lava-fields of Iceland, which have flowed out since the Glacial epoch, cover an area of 4500 to 5500 square miles, and lie scattered in vast expanses around the volcanoes from which they have issued. Most of them are the result, not of one, but of several volcanic eruptions occurring at different periods; but the major part are traceable to pre-historic outbreaks. The most extensive lava-field in the island,

CLIFFS AT THE COAST OF SKAGI, NORTH ICELAND (BASALT).

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* 'Oversigt over de islandske Vulcaners Historie. Avec un résumé en français' (Copenhagen, 1882), 8vo, 170 pp. There is a map appended to the volume. Extracts from this book were printed in the *Geological Magazine*, decade ii. vol. vii. No. 10, October, 1880, pp. 458-467; also in the *Report* of the Smithsonian Institute, Washington, 1886, 47 pp., as well as in *Gæa*, xix., 1883, pp. 464-470.

† The volcanoes of Iceland are described in most of the accounts of my journeys through the country, and in the geological papers which have been already cited. See more especially the articles, "Vulkaner i det nordöstlige Island" and "Vulcaner paa Reykjanes." Besides these, I have written a little book, entitled 'Vulcaner og Jordskjælv paa Island' (Copenhagen, 1897), with 21 diagrams and 6 maps; also "Nogle Bemerkninger om islandske Vulkaner og Lavaströmme," in *Geogr. Tidskrift*, xiii. pp. 140-156.

Odádahraun, which lies on the plateau north of Vatnajökull, at an altitude ranging from 1600 to 3500 feet above sea-level, has an area of 1300 square miles, or counting in all its branches, and all the smaller lava-streams associated with it, its aggregate area runs to 1700 square miles. It owes its existence to innumerable outbreaks from more than twenty volcanoes, the largest of them being Askja. The cubic capacity of the body of lava which in this one place has been ejected from the bowels of the Earth, amounts to a solid cube each of whose sides would measure about 50 miles. The next largest lava-field in the island has originated from several craters of considerable size around Fiskivötn, west of Vatnajökull; it stretches right down to the south coast at Eyrarbakki, and covers an area of 770 square miles. The lava-streams in the peninsula of Reykjanes cover 730 square miles.

The *ejecta* of the Icelandic volcanoes that have been in eruption since the Glacial epoch have been partly liparitic lavas, partly basaltic lavas. The eruptions of liparite have, however, been relatively few, and both their area and their volume are insignificant when compared with the area and volume of the basaltic lavas. The vast deserts of lava, ashes, and scoriæ, which form such a characteristic feature of the island, consist exclusively of basaltic lavas. Previous to the year 1889, only one solitary liparitic lava-stream of age subsequent to the Glacial epoch was known in Iceland, namely, Hrafntinnuhraun; but in that year I had the good fortune to discover three new lava-fields, of a very interesting character, north of Torfajökull.* Seen from a distance, they look like gigantic mounds of coal, for their surface is coated with obsidian. The liparitic lavas, with their heavy blend of salicic acid, flow in a much denser stream than the basaltic lavas. Consequently the currents of the two present a marked superficial difference. The liparite currents are very deep relatively to their length, and have an extremely uneven superficies. Their salient details are exhibited in four typical instances in the subjoined table:—

Locality.	Area, square miles.	Depth in feet.	Proportion of SiO_2.
Hrafntinnuhraun	10	65	69·70
Dómadalshraun	6½	50	69·81
Námshraun	1½	65	62·72
Laugahraun	1¼	165	68·27

The great mass of these four lava-outflows consists of a light grey rock, covered by a thick coating of obsidian, whilst the top or superficial layer is generally a greyish white pumice. There are also many extremely beautiful transitional forms between these several constituents. The predominating grey rock is streaked with veins and bands, which sweep up and down in wide loops and coils. Along the lines of these veins the rock can be easily cleft into thin slates. In prehistoric times the liparite mountains of Iceland seem to have been the scene of several eruptions of the same peculiar character as the eruptions which Junghuhn describes as occurring in the trachyte mountains of Java; for instance, the outbreak of Galungung in 1823. Vast outflows of half-melted and unmelted masses of liparite, poured out from cauldron-shaped depressions, stretch down into the lowlands. Examples may be seen in the Borgarfjördur, in the east, at Drápuhlidarfjall, in the west; but in the most pronounced form, in Lodmundarfjord, on the east coast. In a few solitary cases, liparitic pumice has been ejected by basalt volcanoes; for instance, by Snæfellsjökull, Œræfajökull, and Askja. Fragments of granophyr were discharged by the crater Viti near Mývatn on May 17, 1724.

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* "Om nogle postglaciale, liparitiske Lavaströmme i Island," in *Geolog. Fören. Förhandl.*, xiii. pp. 609–620, 1891; and see also H. Bäckström, "Beiträge zur Kenntniss der isländischen Liparite," *ib.*, pp. 637–682.

The basalt volcanoes of Iceland may be grouped under three typical forms—cone-shaped volcanoes, lava-cones, and chains of craters; the last being by far the commonest. Of the 107 volcanoes which I examined in the course of my journeys, eight were built up of alternate layers of lava and ashes (the typical form of Vesuvius), sixteen were lava-cones (the form of which Mauna-Loa is typical); but the crater-chains numbered not less than eighty-three. And this includes only the chains of larger volcanoes, in which many of the separate craters have been the scenes of violent eruptions. In addition to these, there are numerous chains of smaller volcanic vents and fumeroles. It is a well-established law of volcanic activity in general, that all volcanoes have been thrust up along the great structural lines of fracture on the crust of the Earth. This law holds for the most part in Iceland. It was long ago observed that the volcanoes in the south of the island are grouped along lines which stretch from the south-west to the north-east; and it was believed that they only exist where the substratum consists of tuff and breccias. It is a fact that volcanoes are most prevalent in districts in which breccias predominate; nevertheless that is not exclusively the case. During the course of my journey in 1890, I discovered on Snæfellsnes, and around the Bay of Faxa, a number of volcanoes which had forced themselves up through the basalt, alongside open fissures, and in conjunction with hot springs, in a regular semicircle all round the bay. In the middle of the island, the greater number of volcanoes stand, as I have already said, on a tuff foundation. In the south they stretch in lines from the south-west to the north-east; on the north side in chains running from north to south. Thus, taking them altogether, they form a sort of curve, going obliquely right across the island. The whole of the tuff formation is an area of subsidence. Its many fissures were seats of great activity long before the Glacial epoch, and the activity has continued right down to the present day. So far as is known, twenty-five volcanoes have been in eruption within historic times.

Large cone-shaped volcanoes, built up of alternate layers of ashes, scoriæ, and lava, and resembling in external form the well-known Italian volcanoes of Vesuvius and Etna, are, as I have remarked, not particularly common in Iceland. Their general appearance is sufficiently familiar, resembling a truncated cone with a crater at the top, and often with several smaller lateral craters. The pitch or angle of inclination of the cone depends upon the materials out of which it is built up. In Iceland volcanoes of this class rise at an angle of from 8° to 15° near their base, and shoot up at from 20° to 35° near their top. Most of them are lofty, and consequently are covered with glaciers; for instance, Œræfajökull (6425 feet), Eyjafjallajökull (5595 feet), and Snæfellsjökull (4710 feet). Hekla (5110 feet) is also built up of alternate layers of lava and tuff, but it is not cone-shaped. Its shape conforms to an elliptical ridge, cleft down its major axis, and studded with a chain of craters along the line of cleavage. It is thus an intermediate form between the cone-shaped volcano and the chain of craters. The largest volcano in Iceland, Dyngjufjöll,* with the gigantic crater of Askja, some 25 square miles in area, is likewise an intermediate form. The mountain walls which encircle Askja, and rise to an absolute altitude of 4600 feet, and a relative altitude of 3000 feet, are constituted of ancient and modern lavas and tuffs; and the multitude of crater-chains which line the fissures do not radiate outwards from the centre of the volcano, but cross them irregularly in all directions.

Lava-cones, that is, volcanoes with a slight angle of inclination, and built up entirely of lava, are, on the other hand, very common all over the island. Strange to say, the older geologists who have written about Iceland do not appear to have specially observed this general type of volcano. These lava-cones, which range in size from mere hillocks to the largest mountains in the island, are distinguishable from the country surrounding them, in that they resemble a shield with its convex side uppermost; but, as compared with their extent, their altitude is relatively low. One well-known example of this type is Skjaldbreid, a beautifully formed "dome," which overlooks the heights behind the historically famous Thingvellir; it is like a broad shield, emblazoned with patches of white snow. The angle of inclination on these lava-cones is pretty uniform, seldom exceeding 7° or 8°, more frequently less, often only 1° or 2°, and being at the top but very little steeper than near the base. Their slopes are cased in sheets of granulated lava, and large caves and tunnels are very common in the mountain-sides. The cones generally stand upon a base of vast circumference, and sometimes run up to a considerable height, the top being broken by a circular or elliptical depression, or mouth, of large diameter.

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* "Vulkane im nordöstlichen Island," in *Mitteilungen d. k.-k. geographischen Gesellschaft in Wien*, 1891, pp. 117-145 and 245-288.

Examination of the bottom of these craters proves them to have been at one period lakes of molten, liquid lava (like Kilauea), the surface of which has now swollen upwards, now sunk, and sometimes they have overflowed, pouring vast currents of lava down the mountain-sides to a great distance into the valleys and dales. Sometimes again, after the lake surface has cooled and set, portions of it have been melted again by the underlying heat. Thus fresh outbreaks have occurred, giving origin to smaller cauldron-shaped funnels, which in many cases go down to a great depth. The confining walls of the subsidence (crater) are mostly cleft by rings of concentric fissures, so that they go down from the lip to the bottom of the crater, as it were, in a series of steps. In some cases the crater is completely filled with lava, and the only indication of its circumference is a ring of small lava-pinnacles. The immense lava waste of Odádahraun has been mainly formed by eruptions from this class of volcanoes. The subjoined table will, I hope, give some additional facts about these lava-cones.

Name of volcano.	Absolute altitude in feet.	Relative altitude in feet.	Angle of slope.	Length of crater in feet.	Breadth of crater in feet.
Skjaldbreid	3490	1955	8–10° to E. 4–6° to S.W.	—	920
Heidinhá	2090	1645	2° to W. 3° to S. and E.	625	625
Selvogsheidi	600	600	2–3°	—	—
Skálarfell	270	270	4–5°	310	260
Háleyjarbunga	145	145	3°	455	455
Strytur (in Kjalhraun) ...	2650	—	1–2°	3000	3000
Theistareykjabunga ...	1770	195	1° to W. 4–5° to E.	11,000	2500
Kollóttadyngja	3965	1650	6–7° to N. 8° to S.	1650	1650
Ketildyngja	3115	1805	1–2°	3445	2065
Trölladyngja (in Odáda-hraun)	4890	1970	3–4° at bottom 6–7° at top	3610	1245

The most general form of volcanic formation in Iceland is that of a chain of craters closely following the natural fissures of the ground, and being associated with them throughout their entire length. The separate craters are mostly low, seldom exceeding 350 feet in height, and are composed of loose scoriæ of a dark or brick-red colour. The cones generally slope at an angle of from 20° to 35°, though the inclination is determined by the size of the fragments of ejected material. In some cases the crater gets choked with viscous lava; then the cone is wont to be very steep, occasionally as much as 40° to 50°. The grouping of the separate craters that belong to one linked system is apt to be extremely irregular and complicated. A slight change in the fissure causes the actual point of outflow to shift further on, and in this way there originates a succession of crater rings intersecting one another. Then, again, there are several vents on the circumference of one and the same cone; and sometimes a number of crater rings lie concentrically, one inside the other. The crater chains often extend to a great length. Several of those on the peninsula of Reykjanes are 3 to 10 miles long; but the longest in which there has been volcanic activity within historic times is that at Laki, where there were eruptions in 1783. That chain is nearly 20 miles long, and contains about one hundred craters. On the other hand, others of these crater chains are on an extremely small scale. For instance, south of the large crater, Ketil Dyngja, in Odádahraun, I discovered a Lilliputian volcano, or rather twelve craters, of which the largest had a diameter of 3 feet 4 inches—the others being only 5 to 6 inches across—and all ranged alongside a fissure that was not more than 35 feet long and 4 to 5 inches wide. And yet these miniature volcanoes had hurled lumps of lava to a distance of 15 or 20 yards. There are also several places where the lava has welled up out of fissures without any visible crater. Such fissures are generally small. Nevertheless, some few are exceptionally large; for example, Eldgjá, north of Mýrdalsjökull, which, as I have already stated, is nearly 20 miles long, and has ejected sufficient lava to cover an area of some 270 square miles.

Here and there in different parts of the island one comes across cauldron-shaped depressions (*maar*) in the surface, which have been produced by an instantaneous volcanic explosion. One of the best-known instances of these "explosive" craters is Viti, on the side of Mount Krafla, north of Mývatn. The circular depression was formed by a quite sudden outburst on May 17, 1724. The eruption only lasted a short time, though long enough to start several other volcanoes in the neighbourhood. It was accompanied by a heavy emission of steam, but the only volcanic *ejecta* were ashes and stones. The same crater, which has a diameter of 1030 feet, changed in 1752 into a well of boiling mud, and began to send forth columns of thick smoke and mud. This went on until the year 1840, and then it became converted into a greenish-coloured quiescent lake. A crater of a similar character was formed in the side of Askja through a violent outburst on March 29, 1875. Although measuring but 290 feet in diameter, it shot out such enormous quantities of liparitic pumice that they covered a surface of nearly 2000 square miles in the east of the island, and the volcanic dust was blown all the way to Norway and Sweden. The year after the outbreak the crater was full of steam, but when I visited it in 1884, the only sign of activity was the bubbling and boiling of the bluish-green clay at the bottom of the crater. In all probability this too will, in the course of time, be converted into a little peaceful lake.

Occasionally there have been volcanic eruptions in the sea off the coasts of Iceland, principally off Reykjanes. The volcanic disturbance was most active there during the thirteenth century, five or six eruptions being on record from that period. Several times scoriaceous islands were formed, but they speedily disappeared again. Over against Tjörnes in the north, submarine volcanoes have been in activity at intervals, but more noticeably since 1868. A map by Johannes Ruysch, of the year 1507, shows an island between Iceland and Greenland, and underneath it is this inscription: "Insula hæc anno 1456 fuit totaliter combusta."

The surface of the lava-fields of Iceland present anything but a uniform appearance. Some are very uneven, consisting of innumerable fragments of lava and scoriæ, porous, brittle, and with a clear metallic ring, the separate mounds of lava being heaped together in the most extraordinary fashion. These lava-streams, which the Icelanders call *apalhraun*, are relatively narrow with high edges, looking, when viewed from a distance, like fences or ridges on flat land. A lava-current of this description is very difficult to cross. The fragments of lava are so loosely stacked together that the least touch disturbs their equilibrium. Another variety of surface, called *helluhraun*, consists of immense sheets of lava. This is the characteristic form of the largest lava-fields. Sometimes they are quite level, but more frequently they are broken and cracked in numerous directions. Innumerable twisted and tangled "ropes" of lava undulate in long curves up and down the wave-like surface of the viscous lava. Most of the lava-fields

CLIFFS AT THE COAST OF SKAGI (TUFF AND BRECCIA).

of this class have originally been level, but upon cooling down they have cracked and ruptured, and large sections of them have subsided; so that the surface has thus become uneven and diversified by innumerable small ridges, mounds, circular depressions, and thousands of cracks or crevices. At the side of the large lava-cones there frequently exists a lumpy variety of laminated lava, its surface being, as it were, blistered and crumpled into serpentine knots and furrows all as smooth as hardened pitch. In these laminated lavas there are an immense number of rifts and tunnels. Sometimes the liquid lava underneath has flowed away, leaving hollow spaces beneath the level crust, the which spaces are often long and circular, like gigantic drain-pipes. The largest and best known is Surtshellir, 1762 yards long. Their interior surface is frequently glazed, and a sort of "stalactite" of divers different shapes hangs down from the top. Sometimes the hollow formation and the laminated formation are united in the same lava-current. The upper part, plunging down a steep incline, may be broken and uneven, but upon reaching the flat ground below, it spreads out into a lava-lake with level sheets of lava on the surface. Those lava-fields which lie far above the level of the sea are almost entirely destitute of vegetation; but down on the lowland plains nearer the coast, the older lavas are frequently sprinkled with humus, on which grass, heaths, and scrub manage to subsist. Notwithstanding the plenteous fall of rain and snow, there is scarcely any water to be found in the lava-wastes. The water percolates through the porous lava, and generally gushes up in clear springs along the margins of the deserts, in such number that they often give origin to streams of considerable volume.

Most of the large lava-fields were formed during eruptions in prehistoric times. The quantity of lava that is ejected varies greatly in different eruptions. Some of the outbreaks within historic times have yielded an inconsiderable quantity. But as a rule the lavas which issue during volcanic eruptions in Iceland cover vast areas; indeed, they sometimes stretch over wide districts, like the lava-field of Laki, one of the largest in Iceland, seeing that it hides some 220 square miles of the island's surface. All the same, the ordinary eruptions seldom vomit forth more lava than suffices to cover about 12 to 15 square miles. On the other hand, the lava-currents frequently run to a great length. That of Laki, for instance, is 47 miles long. Another current, which issued before the dawn of history from Trölladyngja, in Odádahraun, is about 70 miles long; and yet another, which flowed from the craters at Fiskivötn, is nearly 90 miles long. These lava-currents have next to no fall. For instance, that from Trölladyngja has an average slope of 0° 41′, and for some 14 miles the lava-sheet lying north of Dyngjufjöll falls at an angle of not more than 0° 20′ 38″. There are, indeed, cases where the torrent, shortly after its emergence, has forced itself upwards over a slightly inclined plane. On March 12, 1875, one of the branches of Sveinagjá worked its way 620 yards up an incline of 0° 25′ at the rate of 35 feet in the hour.

Lava-falls down steep slopes, as much as 30° and over, occur in many places. The highest "petrified" lava-fall is a fourfold one—four curtains hanging one beside the other, 820 feet high, at Selvogur. It must indeed have been a magnificent spectacle to witness the stream of red-hot lava pouring down such a lofty escarpment. In all probability two of the four curtains came into existence during an eruption which took place in 1390.

Groups of secondary craters (*hornitos*) are pretty common on the vast lava-fields. Numbers of them are often clustered together on a relatively limited area. No law can be discerned governing their mutual positions with regard to one another; contrary to what is the case with the larger eruptive craters, which always follow the fundamental lines of cleavage in the crust of the Earth, these *hornitos* are mostly associated with lavas which have flowed over marshy ground or filled up a lake or fjord. Beyond question, the largest group exists at Landbrot, in the south of the island, where hundreds upon hundreds of cones of scoriæ are crowded together upon the surface of a deep and ancient lava-current, measuring some 40 square miles. At Lækjarbotnar, near Reykjavik, there are several small hornitos, which resemble glazed kettles, made of thin laminæ of lava cemented together by the same material.

AN ERRATIC BLOCK NEAR EGILSSTADIR, FLJOTSDALSHJERAD, EAST ICELAND.

Large quantities of salt, especially sal ammoniac, are often deposited on the lava-torrents during eruptions in Iceland. This happened when Hekla was in activity in 1845, and Sveinagjá in 1875. The ancient records of the island tell how, after an eruption of Hekla in 1341, the lava-torrents were strewn with such enormous quantities of salt and sulphur that many horse-loads could easily have been gathered off them.

The quantity of ashes which has been ejected within historic times is nothing like equal in volume to the quantity of lava, and yet at times the showers of ashes have been anything but small. For instance, when the craters in the chain of Laki were in eruption in 1783, they vomited forth a mass of ashes and scoriæ equal to nearly one cubic mile, whilst the lava ejected was equivalent to a mass measuring some 3 cubic miles. The column of ashes on Hekla was measured on April 21, 1766, and was found to rise 16,500 feet above the summit of the mountain; on February 5, 1846, it overtopped it by 14,350 feet. During the eruption of the same mountain in the year 1510, a man in Skalholt, 28 miles distant, was killed by a "volcanic bomb;" and again on April 5, 1766, a fragment of basaltic scoriæ as big as a man's fist was hurled all the way to Vidivellir, a distance of not less than 103 miles. The finer ashes are carried to immense distances. When Mount Katla was in activity in 1625, the ashes fell at Bergen, in Norway; and when Mount Askja was in eruption on March 29, 1875, the pumice ashes were carried right across the sea to the west coast of Norway in eleven hours forty minutes, and in another ten hours they travelled as far as Stockholm. It is an awful visitation when clouds of volcanic ashes pass over the inhabited districts lying nearest to the scene of an outbreak. The pastures are smothered, the home fields and meadows ruined, the sheep and cattle die by scores from want of food and sickness, the latter caused by their eating the volcanic sand with which the scanty remnants of grass are mixed.

After an eruption the sheep are nearly always seized by a sickness, which the Icelanders call *gaddur*. Their molar teeth grow up into high sharp points, which lacerate the gums and the palate, setting up inflammation and causing deep sores, so that the sheep have to be killed. In the winter which followed the terrible eruption of 1783, there died in Iceland 53 per cent. of the cattle, 82 per cent. of the sheep, and 77 per cent. of the horses. Then came a famine, which carried off 9200 persons, or about one-fifth of the total population.

The Icelandic volcanoes often eject a large quantity of vitreous threads, sometimes as much as a yard in length. In appearance they resemble grey horsehair, and are analogous in character to the "Pele's hair" of the Sandwich islands. The ashes from the eruption of 1783 were so acid that they burnt holes in the burdock leaves, and left black patches on the sheep's skins, and the sheep's hoofs turned yellow when they walked amongst them. After the eruption sunsets of extraordinary vividness and intensity of colouring were observed, not only in Iceland, but also in several parts of Europe; and in the former there were many unusual phenomena noticeable in the sky.

Earthquake shocks are also very common in Iceland, more particularly in the central parts amongst the volcanoes. But in the north-west peninsula and in the east of the island seismic disturbances are extremely rare. Closer investigation has proved that most of the earthquake shocks which occur in Iceland are "tectonic" in their nature; that is to say, they take place along the fundamental lines of faultage in the Earth's crust, and they are chiefly confined to three districts, namely, the vicinity of Húsavik in the north of the island, around the bay of Faxaflói in the west, and in the southern lowlands, where they have repeatedly occasioned serious loss of life and property.* On the north coast the volcanic region advances close to the sea, between the two great inlets of the Arctic ocean, Skjálfandi and Axarfjord. Around the shores of both there exist several ancient lava-currents of very considerable dimensions, and in many places the ground is cleft by a number of long and deep rifts. Even at the present day earthquake disturbances are very common in these districts, and often occasion much damage. The last serious earthquake took place beside Axarfjord on January 25, 1885. Great chasms were rent in the earth; huge fragments of rock were loosened from the mountain-sides; farmsteads were hurled down; the sand down on the flat stretches of the shore was whirled up into columns 300 or more feet high; and many crater-like holes were scooped out, measuring from 300 to 450 feet in circumference.† At Faxaflói earth-tremors are very frequent, but seldom cause any damage; they seem to be confined to the semicircular belt of faultings which almost surround the bay.‡

But the part of Iceland which has suffered most from devastating earthquakes is the southern lowlands. That region is fenced in by a ring of steep mountains, and along the line of fracture, where the mountains touch the plains, disturbances and subsidences of the ground are of frequent occurrence, giving rise to serious oscillations of the earth. In this region the earthquake disturbances do not proceed from any recognizable central point, but several sections of the Earth's crust are shaken with startling suddenness one after the other. Very often the seismic movement travels from east to west, beginning at Rangárvellir, one of the eastern parishes of the lowland plains, and stopping at Œlfus, the parish lying farthest west. Sometimes the entire distance is travelled by the successive shocks in only a couple of days; at other times months, and even years, elapse between the upheaval or subsidence of the several sections of the ground. Whilst these districts are in a state of earthquake disturbance, Hekla and the adjacent volcanoes seldom start into activity. Whenever Hekla is in eruption, each outbreak is invariably accompanied by weaker or stronger earthquake movements of the adjoining country; but the disturbances are of a different character from those I have just spoken of, and never at any time so violent.

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* I have printed a general history of earthquake disturbances in Iceland in the Icelandic periodical, *Andvari*, viii. pp. 53-107.

† My description of this earthquake was published in *Mitteilungen d. k.-k. Geogr. Gesellsch. in Wien*, 1891, pp. 272-273; and in *Geogr. Tidskr.*, xiii. p. 115.

‡ See *Geologiske Iagttagelser paa Snæfellsnes og i Omegnen af Faxebugten*, an appendix to the *K. Svenska Vetenskaps Akademiens Handlingar*, vol. xvii. pt. ii. No. 2, pp. 57-60.

During the whole of the thousand years or so that Iceland has been inhabited, the southern lowlands have always been much subject to earthquake visitations. In the last two or three centuries, the most violent and destructive earthquakes have been those of the years 1784 and 1896. The former completely ruined ninety-two peasants' homesteads; the latter was even more disastrous. The many hot springs which there are in this part of the island are constantly changing in consequence of the frequent seismic movements. New ones are unsealed, old ones stopped up. To the same active cause must be attributed the innumerable rifts in the earth, often extending to a length of several miles, as well as the subsidences of land and the alterations in the courses of the rivers.*

The best known of the hot springs are the Great Geysir and the smaller geysers associated with it. But, apart from these, there are hundreds of other hot alkaline springs scattered all over the country. All of them are closely dependent upon the fundamental structure of the island, and a careful study of their mutual relations gives many a useful hint towards elucidating the geological history of Iceland. They exist both singly and in large groups, and of all temperatures up to boiling-point. The commonest are those which are in a state of constant and regular ebullition. The more powerful geysers are rarer. During the earthquake of 1896 a new hot spring burst out at Reykholt in the Biskupstungur, and shot out columns of hot water to a height of more than 30 feet; and its activity still continues. On the same occasion, a natural fountain was formed 50 feet long by 23 wide, from which there issued showers of steam and hot water, shooting up to a height of about 800 feet. But shortly afterwards the upgush ceased, and in July, 1897, the temperature of the water did not exceed 162° Fahr. The widely known geyser of Strokkur, which was started by an earthquake in 1789, ceased its activity during the shocks of 1896, and at the present time its temperature is only about 158° Fahr. During my journeys through the island I have examined nearly every known hot spring, taken the temperature of the water, and drawn plans of some of the more important groups, so that in future it will be easier to ascertain what changes they undergo.* Carbonic acid springs (*ölkeldur*) are found in a few places, but more particularly on Snæfellsnes. On the other hand, solfataras and pits of boiling mud (*maccalubas*) are very common in the volcanic regions where tuff is the predominating rock. The solfataras at Krisuvik and Mývatn are very well known. I also discovered (1888) solfataras of grand proportions and with marked peculiarities in the liparite mountains of Kerlingarfjöll near Arnarfellsjökull. Smaller sulphur springs exist in several other places, more especially on the peninsula of Reykjanes.

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* "Jordskjælv i Islands sydlige Lavland," in *Geogr. Tidskr.*, xiv.

Herewith my brief survey of the geography and geology of Iceland must come to an end. I am painfully conscious of its imperfections; but if I have in this way made it easier for those, who take an interest in the physical phenomena of my native island, to find the sources for the more recent discoveries that have been made, I shall not have written altogether in vain. May I conclude with the wish that on some future occasion I may have the privilege of describing for English readers at greater length some of the more remarkable of the many remarkable physical phenomena which Iceland is able to offer for scientific study?

THE EASTERN GATEWAY OF THE UNITED STATES.

By Prof. A. P. BRIGHAM, Colgate University, U.S.A.

THE mountain barrier of eastern North America stretches from Central Alabama, north-easterly through Labrador. The vast lowlands of the Mississippi valley and the great plains of Canada lie on the west, and the Atlantic ocean, with a rim of coastal lowlands, on the east. The mountains are nowhere lofty as compared with the high mountains of the globe, but they are often rugged, and in the universally forested condition of the early days formed a barrier nearly impassable to human intercourse. The system is made up of elements diverse in age and character. Oldest of all are the Adirondacks of Northern New York, and the so-called Appalachian protaxis of Dana. The latter consists of the highlands of the Hudson, the uplands of New Jersey, South mountain in Pennsylvania, and the Blue Ridge of the Southern states. Extending southward through New England, not far eastward from the Adirondacks are the next oldest mountains of the system, the Green mountains of Vermont, extending south through Massachusetts and Connecticut. They fall in between Ordovician and Silurian time. The newest part of the system is the Appalachian range proper, a great series of folds in

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* I have published a separate account of the remarkable group of springs at Hveravellir, near Langjökull, on the plateau, "De varme Kilder paa Hveravellir i Island," in *Ymer* (Stockholm, 1889), pp. 49-59, with a map. I have also published, in *Geogr. Tidskr.*, xii. p. 223, a map of the hot springs at Torfajökull.

Palæozoic strata, extending from Alabama to Catskill, New York, a point about 120 miles north of New York, on the Hudson river.

By successive deformations, nature seems thus to have walled in the sea-shore from the great heart of the continent. Two gateways, however, lie open. One of these is the St. Lawrence valley, cut along the pre-Palæozoic contact and across Palæozoic beds to the gulf which bears the same name. But with this gateway this paper has little to do. We go several hundred miles to the south, enter New York harbour, and sail up the tidal course of the Hudson. Soon after leaving New York we traverse the trench cut through the ancient highlands. Then we have on the east the Green mountain range, and on the west the low northern terminus of the Appalachian folds. A few miles farther west, and rising far higher, is the great easterly facing escarpment of the so-called Catskill mountains—really the north-eastern terminus of a plateau lying west of the mountain folds from Alabama to Eastern New York.

Leaving tide water at Albany, we rise over a stretch of nearly 20 miles of barren glacial sands to Schenectady, where we find an open road leading to the west. This is the Mohawk valley, the eastern gateway of the country. Northward, or on our right as we go west, rise the rugged foothills of the Adirondack mountains. Southward, on our left, are seen the bold escarpments of the Helderberg mountains, which are really the steep slope by which the long plateau drops off to low ground at its northern end.

To understand the physical history of the Mohawk valley, it will now be desirable to review briefly the geology of the region. New York is classic ground in American geology, and the subject may be touched briefly and dismissed. The outcrops of the older Palæozoic rocks run around the Adirondack nucleus, and border the pre-Palæozoic of Canada on the south. Thus the Trenton limestone, Utica shale, and Hudson river shales and sandstones extend in nearly east and west belts, south of the Adirondacks, dipping slightly southward. The Mohawk valley is cut along the strike of the Utica-Hudson shales (Ordovician) as far north as the south projecting spurs of the Adirondacks would allow. In like manner, only extending further west, we find east and west outcrops of the several Silurian and Devonian formations, until the middle and upper Devonian beds cap the plateau at heights of 2000 to 4000 feet in the Catskills, and 2000 feet or a little less farther west. The northern edges of these formations abut against the Mohawk valley, or, it would be better to say, the valley has been cut into their beds, which once stretched farther north, covering the now exposed lower flanks of the Adirondacks.

Before outlining the history of the valley, let us look more narrowly at its character. We have to do with a trench about 90 miles long, from Rome to Schenectady. Easterly it opens into the broad Hudson lowlands; westerly it widens into the lacustrine plains of Iroquois, the larger glacial antecedent of Lake Ontario. Once pass the gateway at Rome and the path is clear, over the lake plains and prairies to the far west. Seen from the railway as we pass, the valley appears to be a trench about 500 feet deep, with moderately steep sides, and with an average width of river and flood plain of about one half-mile. Seen more truly from the bordering uplands, it is a vast gap, 1500 to 2000 feet deep, several miles wide in its higher parts, lying between the Catskill plateau and the Adirondack mountains. The altitudes are shown in the following table:—

Hudson at Albany	Tidewater
Sand-plains, Schenectady	340 feet
Schenectady	246 „
Amsterdam	279 „
Little Falls	376 „
Utica	410 „
Rome	445 „

From Utica to Syracuse, 53 miles, the Erie canal traverses a single level. From Syracuse to Rochester, 81 miles, the uniformity is nearly as noteworthy. From Rochester to Buffalo, a gentle swell is passed at Batavia at a little above 800 feet. This is, by this route, the highest point between New York and Chicago, or between New York and points far beyond the Mississippi river.

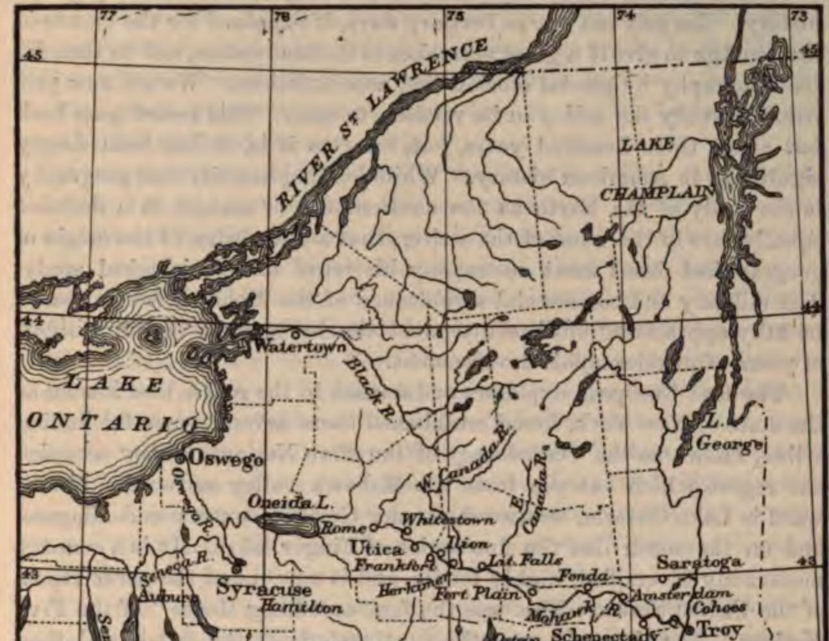
It shall be our aim to see now, first, how the valley was made—in other words, to follow the lines of its physical history; and, second, to see of what importance this gateway has been in the historical development of the empire state, and of the entire country.

We recur to the general fact concerning the geology of the states bordering the Laurentian lakes on the south, namely, that the Palæozoic beds, from the Cambrian to the summit of the Devonian, dip very gently southward from the pre-Palæozoic terranes of Canada and the Adirondacks. Their strikes may be said to represent the position of an old shore-line that was receding southward by the processes of deposition and uplift. The ancient streams must have had their sources on the northern crystalline highlands, have crossed the growing belt of Palæozoic lands, and emptied their waters into the interior sea then covering the coal-areas of Pennsylvania and other states. At an undetermined, but early time, the great St. Lawrence valley, including that of the lakes, was formed, approximately along the northern border of the Palæozoic, but swinging northward of the pre-Palæozoic Adirondack mass. Thus a great body of waters coming from the north was diverted to the east.

The majority of American physiographers who have given attention to the subject, believe that the entire Appalachian belt, from Southern New England nearly to the Gulf of Mexico, was in Cretaceous time reduced to a pene-plain, or nearly to base-level, and that in Tertiary time this body of land was elevated, with warping, to plateau levels of one to several thousand feet. The New York part of the plateau was lifted from 2000 to 3000 feet. During this uplift, it is believed that the valley of the Hudson was in process of excavation. The St. Lawrence was probably earlier in origin. But the streams from the southern Adirondacks were still discharging across central and southern New York, and reaching the sea through an ancient Susquehanna river. The map will show the alignment of these Adirondack waters with the head-waters of the present Susquehanna.

Given now a growing Hudson valley, and outcrops of the soft Utica and Hudson river shales along the southern base of the Adirondack mountains, it was inevitable that a river valley should be excavated along this line from near Albany westward. The headwaters of the young Mohawk ate back into the country to the west, diverting the Adirondack waters to the eastward, and beheading the south-flowing streams of the plateau of Central New York. This headwater cutting proceeded as far as Little Falls, where it was stopped by a barrier of the ancient gneisses, which in very ancient times was faulted up across the line where the valley was later to run. By a process entirely similar, a valley headed back to the east from the ancient St. Lawrence, diverting thither the streams of the south-western Adirondacks, and beheading other Susquehanna head-streams. The col remained at Little Falls until the close of glacial time. Then great discharges of water were sent across the col to the ocean, by way of the Mohawk and Hudson. This resulted in reducing the height of the col by a considerable measure. A further effect of the glacial waters was to aggrade the valley between Little Falls and Rome to such a degree that the divide was transferred from the former to the latter point.

The glacial history of the valley has proved of such large interest in American pleistocene geology as to warrant a further sketch of it. No chapter in our glacial studies has had a more dramatic interest than the formation in the Laurentian and Red river basins of vast glacial lakes, lying, as most believe, between the divide on the south, and glacial dams formed by the retreating ice-front on the north-east. Lake Agassiz has been worked out by Mr. Warren Upham, under the auspices of the Canadian and United States Surveys. Mr. G. K. Gilbert, Dr. J. W. Spencer, Mr. F. B. Taylor, and others, have studied the Laurentian glacial lakes. One of the greatest of these was Lake Warren, stretching from New York far westward, and discharging into the Mississippi basin. The shore-lines of this lake have an altitude of 870 feet in Western New York. Later the Mohawk valley was freed from ice and the discharge turned to the eastward. Prof. H. L. Fairchild has traced for some distance in Western New York the beach of another great lake, at an altitude of 700 feet. Studies by the writer point to another water-level at about 600 feet, with discharge through the Mohawk valley. The principal evidence of this is found in a number of great deltas and delta-like terraces built into the valley at the mouths of lateral streams, from above Rome to Little Falls. Striking evidences of eastward-flowing



PART OF NEW YORK STATE.

waters have been studied by Mr. Gilbert and others, south of Syracuse, N.Y., where cross-channels dissect the spurs of the plateau, and great amphitheatres, cut to depths of 200 feet in the limestone, show the presence, in closing glacial times, of cataracts almost rivalling Niagara.

The Mohawk valley had thus had a long and intricate physical history. Largely cut out in Tertiary days, it remained for the events of the Ice Age to give it a great accession to its headwaters, and to remodel its topography by glacial erosion and accumulations. We are now prepared to study the valley in its relation to man. This record goes back but about three hundred years, but, brief as it is, it has been deeply significant in American history. While holding heartily that geography is the study of the Earth as the environment of man, it is a doctrine equally sure in the mind of the writer, that a knowledge of the origin of geographical forms must accompany historical and sociological study. The military and commercial significance of the Mohawk valley cannot be fully appreciated until seen against the background of the millions of years of physiographic development.

The first European explorers and settlers in the region now known as the state of New York, found established there several powerful Indian tribes, known as the Confederacy of the Five Nations. They occupied the region which extends from the Mohawk valley eastward. Northward is Lake Ontario, westward are the Genesee country and Niagara, and on the south lies the fine series of Finger lakes. It is a country moderately diversified, highly fertile, and is now one of the garden spots of the United States. This was the famous "Long House" of the Five Nations. The Mohawks were the most easterly of the tribes, and they called their fair valley the eastern gateway of the Long House, and they were its keepers. These tribes were in a comparatively advanced state. They practised agriculture extensively, lived in neat and comfortable cabins, possessed considerable industrial skill, were eloquent in public counsel, and were the objects of widespread fear through their prowess in war.

With these sturdy aborigines the European immigrants found themselves in alliance or at war. One avenue of approach was by ascent of the Hudson river. A second was through the Champlain valley from the St. Lawrence. A third lay along the eastern shore of Lake Ontario by the site of Oswego. Thus from the first the rippling waters and bordering flood plains of the Mohawk were a beaten path, frequented by French, Dutch, and English in various contact of war and peace with the natives of the land.

Of these the French were the first to invade the Mohawk country. Not far away, at Ticonderoga, Champlain, the first white actor on this stage, had aided the Hurons against the Five Nations, and had thus, by the enmity aroused, determined for the English the ultimate control of the region. A later invasion was made by the French along the shore of Lake Ontario, but they were defeated and forced to retire. There were peaceful invasions, also, for in the valley captive missionaries endured torture and sometimes death. Most heroic and famous of these is Father Jogue, whose fate has recently been commemorated by a shrine of his church, erected where he perished, on the edge of a glacial terrace south of the river. The final failure of the French to dislodge or convert the natives of the valley was fraught with weighty results in the history of the new continent. Had they won this great highway, they might in later years have maintained themselves on the St. Lawrence, and have held the keys of the new world.

It was the Hudson-Mohawk valley which early guided the Dutch in their effort to carve a slice from the new continent. Under an English commander, Hendrick Hudson, they sailed up the river which bears his name. Coming to the limit of navigation, they built Fort Nassau, below the site of Albany, and concluded a treaty with the Mohawk Indians. Its object was trade, and it went far to prevent French control of the valley. They built Fort Orange in 1622, and thus laid the foundations of Albany. In 1642 Arendt van Curler entered the Mohawk country, reported its lands as "the most beautiful that eye ever saw," and was later authorized to buy the "great flats" where Schenectady now stands. The old town and family names of the lower Mohawk still bear proud testimony to this wave of immigration, in the ever-present Fondas, Schuylers, Sprakers, Sammonses, Van der Veers, and Yosts of the river country.

The first white settlement in the upper stretches of the valley was made by the Palatines in 1723. Following the devastating wars of Louis XIV., thousands of these stricken people left their homes on the Rhine and took refuge in England. Some of these were sent to America, under a compact to reimburse the English Government for their passage, and for the allotment of lands. After a period of great suffering, first on the Hudson and then on the lower Mohawk, a final removal brought them to the German Flats Patent, between Little Falls and Utica. Here each family received a liberal allowance of the rich alluvium and adjacent uplands of the valley, and their descendants have been powerful in the history of the state and nation.

The next wave of immigration which swept up the valley was English. In 1784, Hugh White passed the Hollanders of Schenectady and the High Dutch of German Flats, and founded Whitestown on the upper river. His coming was the signal for a lively movement from the stony slopes of New England to the inviting fields of the Long House, to which the Mohawk was the only road. Then came the stream of emigrant waggons bearing the names of Ohio and Indiana, regions which were then the far distant West.

This stream of travel has never ceased to flow, but has rather augmented a thousand times in the century which has passed. Before considering the Mohawk valley as a highway, however, it will be well to observe that it was the theatre of important military events in colonial times. English forts had been erected on the upper Hudson by the year 1709, and before the year 1712 the chain had been extended up the Mohawk to Fort Hunter, 40 miles from Albany. In 1720, through the influence of William Burnet, son of Bishop Burnet, and Governor of New York, forts were built at Oswego and farther west at Irondequoit bay. About the time of the French war a number were built near the present city of Rome, or in the vicinity of the Oneida carrying-place. "These and similar efforts on the part of the English served to divert from the French into English channels a large Indian trade, and to make the route *viâ* Mohawk river and Oneida lake the shorter one between Albany and Canada, the one most generally travelled." The Mohawk and Champlain became thus great highways trodden by hostile forces in the French and Indian wars, until the French rule came to its end in Canada in 1760. Local histories are filled with exciting records of midnight attack, weary marches in captivity, and all the terrors of border warfare. Here, too, was fought one of the less-known but most critical battles in the struggle between the colonies and the mother-country, the battle of Oriskany. On the south slope of the valley, a few miles west of Utica, the Dutch farmers rallied under Nicholas Herkimer, and defeated the English and the Indians, who would otherwise have gone down the valley and supported Burgoyne in his campaign on the Hudson. The combatants on each side numbered but a few hundreds, but the result is thought by many to have been decisive of the main issue of the war. Since that day the history of the valley has been an unbroken story of peace, and to this we now turn, to consider one of the best illustrations of physiographic control over the movements of man which the New World can supply.

In the pioneer days the Mohawk was considered a navigable stream, and immigrants and freight were conveyed over its waters in boats propelled by poles. Severals breaks were, however, necessary—a first beyond Albany, because of the abrupt fall of 70 feet at Cohoes; a second at Little Falls on account of impassable rapids over the gneissic barrier which the stream there encounters; and a third of 2 miles at the Oneida carrying-place, where the Mohawk is left to the east, and the winding course of Wood creek is followed to Oneida lake. Early legislative authority was given for improving navigation at these points, and soon after 1791 a canal 3 miles long with five locks was constructed at Little Falls, and a further canal conducted boats across the Oneida carrying-place. We read that then enlarged boats with five men could transport, between the terminal points of navigation on the river, twelve tons in ten days. Long lines of waggons and stages also traversed the bottom lands, making the valley a busy highway between the east and the expanding west.

A continuous waterway from the tidal waters of the Hudson to the blue expanse of the Laurentian lakes became now the subject of serious discussion. Enough of the geography was known to suggest the possibility of such communication, but the following order issued to a commander on Lake Ontario in 1814 shows also the extent of the ignorance that prevailed. "Take the *Lady of the Lake* and proceed to Onondaga, and take in at Nicholas Mickle's furnace a load of ball and shot, and proceed at once to Buffalo." "That means," said the perplexed officer, "that I am to go over Oswego falls and up the river to Onondaga lake, thence 10 miles into the country by land to the furnace, and, returning to Oswego, proceed to the Niagara and up and over Niagara falls to Buffalo."

The demand for a water-route was strengthened by the danger that the growing commerce of the Genesee country would be diverted either down the St. Lawrence to Montreal and Quebec, or by the Susquehanna to Philadelphia. It is difficult to assign credit for the first suggestion of an Erie canal. Probably the idea was conceived independently in several thoughtful minds. Such a prediction is said to have been made by Captain Joseph Carver in 1776. Elkanah Watson, describing a westward journey in 1788, voiced his "strong presentment that a canal communication will be opened sooner or later from the Great Lakes to the Hudson." Governeur Morris is reported to have said in 1803, "Lake Erie must be tapped, and the waters carried across the country to the Hudson." He thought there should be a uniform declivity between the two, not taking account of the height of land in Western New York. The legislature took up the matter in 1808, a survey was made, and in 1810 a commission was appointed. The project then fell into abeyance, until revived by De Witt Clinton in 1817. Navigation was finally opened between Lake Erie and the Hudson on October 26, 1825. The price of transportation from Albany to Buffalo, about 300 miles, gradually declined during the twenty-six years after the opening of the canal, from $88 to $5.98 per ton. Later, railway competition became effective, and transportation from Buffalo to New York in 1885 was but $1.57 per ton. Of the vicinity of Rochester, it is said, upon completion of the canal, that her timber found market and floated away, wheat quadrupled in price, the mud dried up, the mosquitoes, the ague and fever, and the bears left the country, and prosperity came in on every hand. In like manner, the salt, gypsum, lime, and grain of Onondaga, where is now the great city of Syracuse, found ready market. But it is not enough to cite these comparatively local results. The meaning of the Mohawk valley is that the entire region of the Great Lakes, and the vast prairie and mountain regions of the West, became tributary to the rising metropolis on Manhattan island. Hence it is that New York, rather than Boston or Philadelphia, or Baltimore, is the metropolis of the Western Hemisphere.

A similar story has now to be told of railway communication through this valley. There was no railroad in America prior to 1826. In that year a horse-railway 4 miles long was built at Quincy, Mass., for the transportation of granites from the quarries. In the same year the legislature of the state of New York granted a charter to the Mohawk and Hudson River Railway Company to build a road from Albany, on the Hudson, to Schenectady, on the Mohawk, a distance of 18 miles. This was the first chartered railroad in America. It was completed October 31, 1826, and at once carried four hundred passengers daily. This, it will be remembered, was soon after through traffic began on the Erie canal. In 1833 a charter was granted for a road to extend from Schenectady up the river to Utica, a distance of nearly 80 miles. This division was in running order in 1836. A further link in the westward series between Syracuse and Auburn was finished in 1837, and from Utica to Syracuse in 1839. A curious argument was urged for a break in the chain of roads at Utica, namely, that otherwise it would become a mere way station on a great line, and its business would fail to develop. The discussion shows that the consolidation of the future was forecast at an early time. Gradually the line was completed from New York to Buffalo, 450 miles, and became known as the New York Central and Hudson River railway, or more commonly as the New York Central, one of the greatest railways of the world. Four tracks lie side by side from Albany to Buffalo, two being used for passenger traffic, and two for the conveyance of freight. Owing to the abrupt descent of the valley slopes to the river, but two tracks lead from Albany down to New York. The seaboard terminal is New York with its three millions of people, and an adjacent suburban population in New Jersey of more than a million. At the western terminal is Buffalo, the eastern goal of lake navigation, with nearly four hundred thousand people. On the line are Rochester, Syracuse, Utica, and Albany, nearly a score of smaller cities and innumerable busy towns. A great number of minor railways pour their tribute into this great artery of transportation, and it is hardly true to call Buffalo a terminal point, since many solid trains each day push on without change both south of the lakes and across Niagara, through the dominions of Her Majesty the Queen, 500 miles further, to Chicago. There is not a difficult grade or an embankment or trestle of any importance between New York and Buffalo, and with slight exception this holds good from Buffalo to the Rocky mountains. Two thousand miles of splendid country are thus made tributary to the harbour of New York through the river gateway which we have described. About twenty years ago a competing line with two tracks was constructed, and called the West Shore railway. It extends up the Hudson on the west side, along the Mohawk on the south side, and thence closely parallel to the Central railway to Buffalo. For the most part the same towns are served by the two lines, and the newer has now become an integral part of the older system, so that the

New York Central virtually crosses the empire state with a line of six parallel tracks. It should be added that the second telegraph line in America joined Albany and Utica along the Mohawk valley, being finished on January 31, 1846. A short line between Baltimore and Washington preceded it by two years.

To sum up, the valley is now threaded by the ancient highways, the Erie canal, six railway tracks, and innumerable telegraphs and long-distance telephones, by which New York converses with Detroit, Indianapolis, Chicago, and other western cities. The passing up and down —day and night—of men, of thoughts, of commodities, is like the ebb and flow of tidal waves whose course is only stayed as traffic rests on the docks of Europe and of more distant continents.

But it must not be thought the Mohawk is the only road which has been sought out to the West. It is only a broader gate with a lower threshold. There are other great railways, but none of them passes the Appalachian belt at an altitude of 445 feet. A brief comparison will be instructive. Take first the roads which traverse the empire state from the seaboard. Much English capital was vested in the Erie railway. Perhaps the flow of money would have been less free had its sinuosity and heavy grades been known. At 75 miles from New York it must attain a height of 870 feet to pass the Kittatinny mountains. At Port Jervis the altitude is 442 feet; at Deposit, 1008 feet; near Elmira, 799 feet; and at Castile, 1401 feet, with some large embankments and difficult bridges. Likewise the New York, Ontario, and Western railway, running to Oswego and the west, crosses difficult divides, and rises and falls between low altitudes and maxima of nearly 1800 feet. The Delaware, Lackawanna, and Western railway rises to 1932 feet at Tobyhanna Pa, and in 27 miles descends to 745 feet at Scranton. Thence it passes into New York, where it varies between 846 feet and 1359 feet.

Of the roads which cross the Appalachians south of New York, the conditions are similar. The Lehigh Valley road from Philadelphia maintains a course below 700 feet for 100 miles; then in 30 miles climbs to its summit, 1728 feet; and in 20 miles more drops to 549 feet at Wilkesbarre. The Pennsylvania, one of the finest roads in America, is obliged to make at one point an altitude of 2161 feet, and has one section of 5 miles whose grade is 80 feet per mile. The Baltimore and Ohio road, still farther to the south, has its summit at 2620 feet. Farther south the facts are yet more striking, and it is less than twenty years since a railway first crossed the southern Appalachians. The early hunters and settlers who entered Kentucky and Ohio from Virginia and the Carolinas, sought the high and difficult passes of the mountain and forest, crossing, so to speak, the grain of the country, while along the Mohawk the Dutch and English walked in as by an open door.

In conclusion, let us return to the winding waters and fertile flood-grounds of the Mohawk. After its sources leave the high hills of

Central New York, it follows from Rome to the Hudson, a short course of 110 miles. Upon its banks are six cities, all good illustrations of physiographical control. Rome, with 15,000 people, is built at the Oneida carrying-place; Utica, a thriving city of 60,000 souls, is determined by an old fording-place, and receives tribute from Central New York through a number of lateral valleys. Little Falls, a small but busy city, depends upon an ancient carrying-place and its water-power, the primal cause being an extensive fault which here crosses the river from north to south. Farther down is Amsterdam, a city of 20,000, and a great centre of knit goods and carpet manufacture. Schenectady, with 25,000 people, lies on the great flats, where the river issues from the uplands upon the old estuary ground of the Hudson, as it was in a time of continental depression. The last is Cohoes, a city of looms, whose superb water-power is due to the falls of the Mohawk, just before it enters the Hudson. The lower Mohawk was thrown out of its course by the events of glacial time, and discovered the ledge over which it descends. Nine towns of 2000 to 5000 population are also scattered along the river, with many smaller villages; while the stretches of alluvial field, backed by rising meadows and forests, offer scenes of greatest beauty.

The writer has seen the valley from every point of view, has lived in it, and gone up and down its course for many years, and scarcely knows whether to delight more in its physiographical history, its simple rural charm, or in the thronging life which marks it as one of the greatest highways of the world.

DELIMITATION OF THE BRITISH AND FRENCH SPHERES IN CENTRAL AFRICA.

By the agreement arrived at between Great Britain and France, the terms of which are embodied in the Declaration signed in London on March 21 last, one of the most thorny questions connected with the partition of Africa has at last received a satisfactory solution. Taken in conjunction with the Convention of June, 1898, to which it is regarded as an addition, the agreement completes the delimitation, in principle if not in detail, of the entire spheres of the two powers in Central and West Africa, and at the same time removes the last important area of debatable ground from the map of the whole continent.

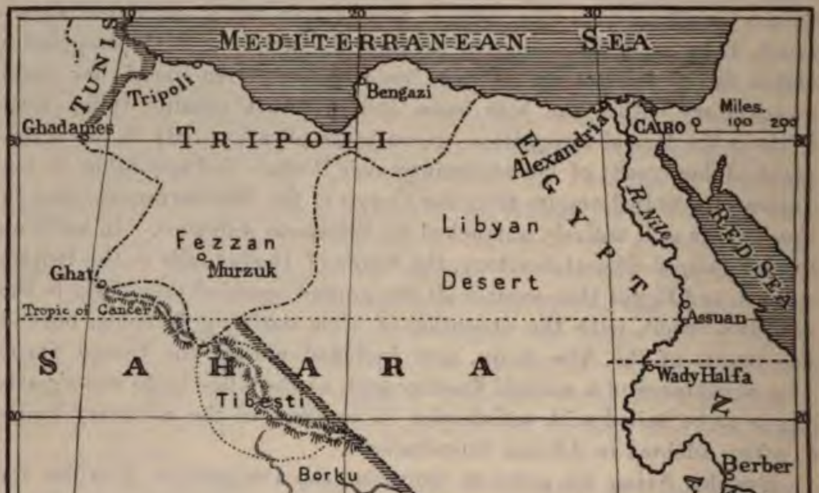
The region lately in dispute forms, as it were, the central core of the African continent, on which the forces of civilization have been gradually converging from north, east, and west. As guardian of Egypt, and also in virtue of her protectorate on the headwaters of the Nile, Great Britain has since 1890, when the claim was first definitely made in the Anglo-German agreement of that year, sought to retain within her sphere of influence the whole basin of the Nile, while France, in her forward march from the West Coast, has pursued the double object of gaining access to that river and of uniting into one homogeneous whole her entire territory from the Gabun to Algeria. The conflicting claims resulting from this state of things have, under the recent agreement, been settled by what is perhaps the most rational compromise under the circumstances. France has once for all renounced her claim to territory within the Nile basin, and in return obtains from Great Britain the formal recognition (given by implication only in the agreement of last year) of her suzerainty over Wadai—indispensable to her dream of a united empire from the Congo to the Mediterranean, though the land is still entirely untouched by European influence. In addition to the Bahr-el-Ghazal territory, the whole of Darfur falls to the British sphere, and Egypt thus secures all the ground occupied previously to the Mahdi's revolt, with the exception of some outlying districts, beyond the limits of the Nile basin, now included within the Congo State. The acceptance of a natural frontier such as the Nile-Congo water-parting is to be hailed with satisfaction in contrast to the arbitrary limits so often adopted in African delimitations.

Besides fixing the political frontiers, the Declaration provides for equality of treatment in commercial matters within a zone lying between 5° and 14° 20′ N. lat., and between 14° 20′ east of Greenwich and the upper Nile. Taken together with the similar zone laid down last year for West Africa, and with the Free Trade zone defined by the Berlin Conference, which itself reaches to 5° north, this secures a free field to British trade throughout a large area not actually within our spheres of interest, and is additional matter for satisfaction in the present settlement.

For purposes of reference, it may be convenient to print in full the paragraphs of the Declaration relating (1) to the frontier on the respective sides of which the two Powers renounce political action; (2) to the French boundary north of 15° N. lat., at which the first-mentioned line terminates. They are as follows:—

"Par. 2.—The line of frontier shall start from the point where the boundary between the Congo Free State and French territory meets the water-parting between the watershed of the Nile and that of the Congo and its affluents. It shall follow in principle that water-parting up to its intersection with the 11th parallel of north latitude. From this point it shall be drawn as far as the 15th parallel, in such a manner as to separate in principle the kingdom of Wadai from what constituted in 1882 the province of Darfur; but it shall in no case be so drawn as to pass to the west beyond the 21st degree of longitude east of Greenwich (18° 40′ east of Paris), or to the east beyond the 23rd degree of longitude east of Greenwich (20° 40′ east of Paris).

"Par. 3.—It is understood, in principle, that to the north of the 15th parallel the French zone shall be limited to the north-east and east by a line which shall start from the intersection of the Tropic of Cancer with the 16th degree of longitude east of Greenwich (13° 40′ east of Paris), shall run thence to the south-east until it meets the 24th degree of longitude east of Greenwich (21° 40′ east of Paris), and shall then follow the 24th degree until it meets, to the north of the 15th parallel of latitude, the frontier of Darfur as it shall eventually be fixed."



SKETCH-MAP ILLUSTRATING ANGLO-FRENCH AGREEMENTS OF 1898 AND 1899.

The accompanying sketch-map shows the lines here laid down, the former of which is to be the subject of delimitation on the spot by commissioners representing the two governments. The approximate western limits of Darfur are shown by a strong dotted line, while the extreme limits within which the frontier is to be drawn are also marked. With reference to Par. 2, it may be observed that the Nile-Congo water-parting ceases at about 8° 30′ N., and that thence to 11° N. it is the Nile-Shari water parting which, according to the spirit of the agreement, must be followed. The strict letter of the declaration would equally allow the adoption of the Congo-Shari water-parting between these latitudes. As regards Par. 3, it is to be noticed that, though Great Britain allows the claims of France to a large area of the Central Sahara north of 15°, including the mountainous country of Tibesti, she makes no claim herself to the territory on the other side of the line laid down, which therefore still remains outside any recognized sphere. As, however, it is occupied by the Libyan desert, perhaps the most inhospitable tract of the whole Sahara, it is little likely to become the object of acquisitiveness on the part of any Power. This is less the case with Tibesti, which, besides, naturally belongs to the *Hinterland* of Tripoli, and the present recognition of French claims will not, of course, be binding on other Powers. It is not quite clear whether the line laid down is intended to be drawn due south-east from its starting-point, for if so, it might possibly strike the frontier of Darfur before reaching the 24th meridian, which would then form no part of the French frontier.

It has been pointed out, in connection with the recent agreement, that the lease of the Bahr-el-Ghazal province to the Congo State in 1894 has never been cancelled by any agreement with this country, although by that with France in the same year the State undertook not to exercise any political influence north of 5° 30′ N. It is not to be expected, however, that this question will be opened by the State authorities, and it may be remarked that the chief concession made as a set-off to the lease has not been enjoyed by Great Britain, while other adjustments of frontiers in 1894 were mainly to the advantage of the State. Thus, whereas the 30th meridian formed the original eastern limit of the State in the direction of the Nile, the frontier was in 1894 advanced eastward so as to include the extreme corner of the Congo basin, without any corresponding rectification further south, where a portion of Lake Albert Edward and the Semliki valley fell to the State, although on natural grounds forming part of British East Africa.

In addition to the Libyan desert, the only portions of Africa not yet brought nominally under the influence of any European Power are the states of Abyssinia and Morocco, and it is in respect of these chiefly that future frontier difficulties may be expected. Should these states permanently maintain their independence, questions would still have to be settled between them and neighbouring Powers. The interior limits of French Somaliland are still undefined, while the exact frontier between Eritrea and Abyssinia has not yet been drawn, to say nothing of that between Abyssinia and the Anglo-Egyptian territory. Of other territorial points still unsettled, the chief are the Anglo-Portuguese frontier on the upper Zambezi; the Anglo-German frontier behind the Gold Coast[*]; the Congo-German frontier north of Tanganyika[†]; the exact limits between French and Italian territory on the Red sea; and, lastly, the interior limits of the Spanish Sahara.

THE NEW TANGANYIKA EXPEDITION.

Mr. J. E. S. Moore, accompanied by Mr. Berridge and Mr. Arnold Matthews, two other members of the new expedition for the further exploration of Lake Tanganyika, left London on April 19 last for Zanzibar, where they will stop a short time to engage the services of the necessary carriers and other native attendants. When this is effected, they will go on to Chindi, where Mr. Fergusson, the surveyor and geologist of the expedition, will join them. The whole party will then proceed by the Zambezi and Lake Nyasa route to the south end of Lake Tanganyika, which they expect to reach some time in July. For the better exploration of Lake Tanganyika, it has been arranged to obtain from the African Lakes Company the use of their steamship, which is at present the only one on the lake, although we believe that a second steamer for Tanganyika is now being built, and will shortly be placed on that lake by the Tanganyika Exploration Syndicate.

Many months—it is not possible to say exactly how long—will be devoted to the exploration of Lake Tanganyika, its fishes, mollusks, and other products, both animal and vegetable, for which purpose Mr. Moore has taken with him a complete set of dredging apparatus, and all other modern appliances adapted to facilitate dredging and netting at considerable depths. It is hoped in this way that the knowledge of the strange fauna of Lake Tanganyika already acquired by Mr. Moore during his previous expedition, will be greatly supplemented. Meanwhile, Mr. Fergusson will devote himself to the examination of the geological structure of the ranges on both sides of Lake Tanganyika, and ascertain, as far as possible, what formations occur along its shores. Mr. Fergusson will also take observations for cartographical purposes, the expedition being well supplied with instruments by the Society.

After the necessary time has been devoted to Lake Tanganyika and its geological history, Mr. Moore and his party will proceed to the north end of the lake, and endeavour to make their way thence across country northwards to the south end of Lake Albert Edward. This piece of country, which is about 300 miles in extent, has never yet been crossed from south to north by any European party, and is of very great interest; it is believed to be part of the "Great Depression," which extends for an enormous distance from north to south through Central Africa. About halfway between the two great lakes is the small lake Kivu, which will require thorough examination in order to ascertain whether its fauna corresponds in any degree with that of Lake Tanganyika. Kivu was visited by Graf v. Götzen in 1893, during his adventurous journey across Africa from east to west, but few particulars regarding its physical structure, and none, we may say, about its living products, were obtained. The same ignorance prevails concerning the physical and faunal characters of Lake Albert Edward, which has, indeed, been hardly visited except by hasty passers-by. The Tanganyika explorers have, therefore, an ample field before them for discoveries in geography, as well as in natural history and geology.

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[*] Apart from the question of the neutral zone, the White Volta has never been accepted by Great Britain as the German frontier north of 10° N.

[†] M. Wauters has maintained that the State frontiers have been completely defined by international agreements. But it is, we believe, the case that the map attached to the treaty with Germany in 1885 showed the boundary more to the west than other documents of about the same date, by which Germany might with reason refuse to be bound.

On arriving at the south end of Lake Albert, Mr. Moore hopes to be able to arrange to be met by the boats of the Uganda Administration, which navigate that lake.

The members of the Tanganyika Exploration Committee are Prof. E. Ray Lankester, F.R.S. (chairman); Sir John Kirk, G.C.M.G.; Sir William Thiselton-Dyer, K.C.M.G.; Mr. P. L. Sclater, F.R.S.; and Mr. G. A. Boulanger, F.R.S. Besides the sum of £600 granted to the Tanganyika Exploration Committee by the Geographical Society, Mr. Alfred Beit has made a generous donation of £1000, and two other gentlemen, who do not wish their names to be published, of £500 each; while Mr. Berridge, one of the members of the expedition himself, contributes £1500, and other smaller sums have been received. The expedition is expected to be absent two years, or nearly so.

THE MONTHLY RECORD.

THE SOCIETY.

The National Antarctic Expedition.—At the meeting of the Society on April 24, the President announced that H.R.H. the Prince of Wales had graciously consented to become Patron, and H.R.H. the Duke of York Vice-Patron, of the National Antarctic Expedition.

EUROPE.

Scenery and Vegetation of the Mountains of Bukovina.—An interesting paper on this subject appears in *Globus* (vol. lxxiv. No. 24) from the pen of Baron von Hormuzaki, who had previously treated of the broad climatic, faunal, and floral regions into which Bukovina may be divided. Bukovina is a land of surprising contrasts, arising both from the varying nature of its physical characters and from the unequal distribution of man's activity, all gradations being seen from the most intensive cultivation to the untrodden primeval forest. Of the whole surface, 44·59 per cent. is covered with wood, while in the mountains the proportion mounts to 60 or even 80 per cent. Of the wooded area, again, 75 per cent. is occupied by conifers (especially the spruce fir), while only 16 or 17 per cent. falls to beech woods, so that the name of the province ("land of beeches") is by no means strictly applicable. The zone of the Carpathian sandstone, which is the first reached from the lowlands, is marked by great uniformity, and the wooded, humus-covered ridges have so slight an angle of slope that their summits are generally invisible from the valleys. Even in the higher mountains this type is prevalent, except in the limestone ranges and the highest parts of the primitive formation. Great contrasts are to be seen in the character of different main valleys as regards climate and vegetation. The opposite extremes are formed by such valleys as that of Solka—temperate and humid, with luxuriant growth of trees (silver fir, spruce, and beech), draped with moss, ferns, and lichens—on the one hand and of the Moldova, in its central part—hot and dry, with remnants of a steppe flora, and often bare hillsides—on the other. The existence of different types of vegetation in different districts is due partly to natural causes and partly to the action of man. The zone of conifers begins on the plain at a distance of about 12 miles from the mountains, the silver fir here predominating. In the more central parts beeches become more numerous, and, as firs alone are cut for export, often usurp the place of the characteristic mixed forests. Unmixed forests of conifers again appear in the higher region, being here formed mainly of spruce. The writer gives an interesting account of the various modes of transformation of forest into pasture, and the re-forestation of the latter where neglected, enumerating various transition forms between the two, in which birches often play an important part. Except in the steppe region and above the limit of trees, natural brushwood does not occupy any large area. Heather is hardly met with at all, but there are heath-like tracts with sphagnum and vaccineæ; also true peat-mosses and elevated grassy regions with alpine flowers, etc.

The Lakes of the Böhmerwald.—In the first number of the new volume of the *Geographische Zeitschrift*, Dr. Halbfass gives a short note on P. Wagner's study of the lakes of the Böhmerwald, which has been recently the subject of a dissertation at Leipzig by that observer for the degree of doctor. The principal results are said to be as follows: (1) Confirmation has been obtained of the view of Partsch and Bayberger—doubted by Penck and others—that the lakes in question are the results of ice-action during a glacial period, certain of the lakes having been shown to be held back by moraines, while polished and striated boulders have been found in their vicinity; (2) the shape of basin differs little in the case of the separate lakes; (3) diminution in area by the deposition of sediment is going on in all the lakes, but at very different rates. In the Great Arber-see and the Rachel-see it is much more rapid than in the Swarzer-see, in accord with the far greater extent of the area of precipitation in the two former cases. The last-named lake is the largest and deepest (130 feet), but the Teufels-see, with little more than a third its area, has a depth of 118 feet. The altitudes above sea-level are respectively 3307 and 3379 feet.

The Navigation of the Loire.—The second number of the *Tour du Monde* for the current year contains a short account by L. Gallouedec of the history of navigation on the Loire, the present state of the river, and the steps lately taken for its improvement as a waterway. It is pointed out that, though at the present day the Loire is almost deserted, it was much frequented during the early part of the century, until the introduction of railways rendered the river-traffic unremunerative. The chief difficulties arise from the nature of the river itself. Although subject to occasional devastating floods, it contains, as a rule, quite an insufficient supply of water, its bed being encumbered with shifting sandbanks, between which the channel meanders in a constantly varying course. In 1895, a company was formed at Nantes for the improvement of the waterway between that town and the confluence of the Maine, and it is hoped that in time vessels may again ply between

Nantes and Orleans, partly by the river itself, its bed being deepened and improved, and partly by a lateral canal. For the needs of the immediate future, an attempt has been made to utilize the river in its present condition by the adoption of light-draught vessels of a special type. The first of these, named the *Fram* after a more famous pioneer in another field, has already been launched, and made its first voyage from Nantes to Orleans in August and September last. It has a length of 135 feet, and maximum breadth of 18; the bottom is flat, without keel, and when fully laden with 80 tons of merchandise, the vessel draws only 2 feet 4 inches, its speed varying from 8 to 10 miles an hour. It remains to be seen whether the venture will be successful in diverting traffic from the railway to the river.

ASIA.

German Explorations in Asia Minor.—In Asia Minor, which has for so long been a special field of German research, considerable additions were made to our knowledge by journeys of German travellers carried out in 1896, of which the results have lately been published. Major von Diest, who with a brother officer made extensive journeys in the less-known parts of the basin of the Sakaria, gives the narrative of his experiences in a supplementary number of *Petermanns Mitteilungen* (No. 125), with much information on the ancient geography of the districts visited. With the aid of Dr. B. Hassenstein, he has prepared a revised map, in three sheets, of a considerable area of north-west Asia Minor, on the scale of 1 : 250,000. This is also the scale of Kiepert's great map, which has been used as the groundwork for that of Major von Diest, whose explorations (of 1886 and 1892, as well as 1896) have, however, enabled him to make many corrections in the topography. All the most important routes of recent travellers are shown, together with the railways, roads, and bridle-paths, and, where possible, the boundaries of administrative divisions. The nature of the surface features is shown with great clearness, and much information is given respecting the distribution of races, the villages being distinguished by symbols according to the affinities of their inhabitants. Major von Diest's routes followed for the most part bridle-tracks through the districts bordering on the Anatolian railway between Ismid and Angora. The most important deviations were, firstly, that to the town of Sidi-gasi, now identified with the ancient Nacoleia, on the upper waters of the Sakaria; and, secondly, a wide *détour* from Beilik-aghir, in the Pursak valley, through the country at the foot of the Ala-dagh, to Angora. Much new light is thrown on the hydrography, which presents some interesting phenomena. Describing the system of the upper basin of the Kirmir-chai, Major von Diest says, "The whole collected waters of the Kurt and Jaila Dagh, united into three main channels, pours itself at one and the same spot into a rocky rent, formed as if artificially by two perpendicular cuts, and, after rushing southwards for half a mile, winds eastward in sharp curves through the mountains, and makes its way to the plain through the rock-portal of Jabanoa, 600 yards long." Some interesting details are given respecting the Angora railway. From that place to Bosujuk it traverses the bare, uninteresting plateau, but thence to Ada Bazar the journey is one of the most interesting possible. Descending through the deep cleft of the Kara-su, the line climbs down by giddy terraces, bridges, and rocky passes, and in one section there are fourteen tunnels within 3 miles.—Dr. W. Judeich's explorations, an account of which appears in the *Sitzungsberichte* of the Berlin Academy of Sciences (vol. 36), were undertaken for the purpose of supplementing some parts of Dr. Kiepert's map. They were chiefly concerned with the western and northern districts of ancient Mysia, especially the Scamander valley, the mountains south of the Troad, and the Kara Dagh and other ranges in the country bordering on the Sea of Marmora. The paper treats largely of antiquarian remains, but contains new geographical matter, about sixty new places having been added to the map.

M. Bonin's Journey in the Chinese Empire, 1895-96.—The last part of the *Bulletin* of the Paris Geographical Society for 1898 contains a note by M. Bonin on the geographical results of his journey in Tibet, China, and Mongolia, of which some details were given in the *Journal* in 1897 (vol. ix. p. 515, vol. x. p. 94). It will be remembered that one of the most interesting geographical results of the journey was the discovery that the Yang-tse north of Tali-fu makes an unsuspected great loop to the north. The map now published lays this down somewhat differently from the sketch-map given with the preliminary account, as it shows the main stream as returning southwards to the bend near the Tali-fu lake, where it was crossed by Mr. Hosie, and thus removes the necessity of supposing that the latter traveller had mistaken a tributary for the main stream. M. Bonin's delineation is supported by the itineraries of caravans between Ta-tsien-lu and Tali, which cross the stream only a day and a half south of Yun-ning-tu-fu. The divergence is caused by a great range, with peaks varying between 16,000 and 20,000 feet. M. Bonin's exploration in the valley of the Yalung are also of much interest: on one of the passes by which the ranges on either side of its deep valley are crossed, he found what he considers the highest inhabited station on the globe. It is the abode, even in mid-winter, of a few yak herdmen, and lies at an altitude of 16,560 feet, or 500 feet higher than the mines of Thok-Jalung. M. Bonin compares this region to the Pamirs, though its deeply cut ravines would seem to be very different from the broad valleys of the latter. There are only two practical routes across it, one on each side of the central *massif*. Another section of the route on which information has hitherto been scanty is that from Cheng-tu to Lanchau. In the upper basin of the Kia-ling it led through country since visited by Mr. Litton (*Journal*, vol. xii. p. 187), but beyond this it traversed the divide between the basins of the Yang-tse and Hwang-ho, on which M. Bonin was able to throw new light, as his itinerary deviated from that of Potanin. The chains do not here run from east to west, but there is a rapid rise of level towards the west, forming the eastern edge of the Tibetan plateau.

Dr. Nieuwenhuis' Explorations in Borneo.—We have already referred briefly to Dr. Nieuwenhuis' successful journey across the island of Borneo, during which the Kapuas, the principal river of the south-east coast, was ascended to its source, and the west coast reached by way of the Mahakam. A full account of the journey, given by the traveller last year at a public meeting in Batavia, has appeared in the *Tijdschrift voor Indische Taal-, Land-, en Volkenkunde* (vol. xl. parts 5 and 6). The speaker began with a short general sketch of the island and the history of its exploration, drawing a strong contrast between it and the neighbouring island of Java, which presents a varied appearance and abundant signs of civilization as compared with the almost unbroken sea of vegetation met with in Borneo. The expedition was first set on foot in 1893–94, when Dr. Nieuwenhuis was associated with Prof. Molengraaf and Drs. Büttikofer and Hallier; but difficulties prevented the full realization of the plans at that time, though Dr. Nieuwenhuis paved the way to future success by establishing friendly relations with the Kayans on the Upper Kapuas. During his residence among this tribe he was able to collect a considerable amount of information respecting their manners and customs. He considers that, with proper regard on the part of travellers to the feelings and social regulations of the natives, there need be little fear of serious difficulties with them. One of the most singular beliefs among the Kayans is to the effect that each individual possesses two souls, which are ever ready to take flight, and thus entail various maladies on the body with which they are associated. The tribes on the headwaters of the Mahakam are nearly allied to the Kayans, and Dr. Nieuwenhuis obtained the promise of the latter's support in any attempt to pass through the Mahakam region. Other duties delayed the renewal of the attempt till 1896, when Dr. Nieuwenhuis again reached the Kayan country, accompanied by assistants for the investigation of the zoology and botany of the districts visited. With the aid of the Kayans, the uninhabited tract between the Kapuas and the Mahakam was successfully crossed, and friendship established with the tribes on the latter river, in spite of the intrigues of a Malay freebooter who sought to prejudice the natives against the travellers. All the tribes of this region form a single group included under the name Bahau. They differ much from the Dayaks of the Barito and Kapuas, both physically and in their more independent bearing. They have a common commercial language, which is understood widely in North and East Borneo. Some difficulties arose owing to the scarcity of provisions among these people, but on purchasing a supply of rice from a neighbouring tribe, the party were allowed to establish a station in the virgin forest, where a considerable time was devoted to the zoological and botanical collections. Excursions were also made to various mountain summits for the purpose of checking the compass surveys. Finally, in December, 1896, canoes were purchased from the Pnihings, a neighbouring tribe, and in spite of the many rapids the Mahakam was safely descended to the head of steam-navigation at Tepu. In spite of attacks of malaria, the party generally maintained good health, much attention being paid by Dr. Nieuwenhuis to the question of hygiene. He is of opinion that the first requisite in malarious districts is the avoidance of chill, and insists on the necessity of woollen clothing for this object.

AFRICA.

Captain Wellby's Journey in the Galla Countries.—We have been favoured with details respecting Captain Wellby's expedition, contained in a letter from that traveller, dated "Lake Lamina, January 25, 1899." From the Maki river, which flows into Lake Zuai, Captain Wellby had proceeded *viâ* the western shores of Lakes Zuai, Hora, and Lamina to the camp from which he wrote, situated close to Wubarak. Lake Zuai was found to be fresh, the Suksuk river flowing from it between high chalk banks to Lake Hora (this, and not Hogga, is the true name). Both Hora and Lamina contain soda and saltpetre, but the latter is by far the more brackish of the two; all are full of hippopotami. On Lake Zuai and the Suksuk representatives of the Arusi Gallas were met with, but they were miserably poor, though formerly more flourishing. They are known as Waiyu and Gombo. West of the two northern lakes the country is said to be uninhabited. There are inhabited islands in Lake Lamina, but on attempting to reach them Captain Wellby was chased by canoes, though he succeeded in getting away without bloodshed. West of Lamina he came upon the Tuki Arusi Gallas, living close to the river Jiddo. They are friends of Menelik, to whom they give one tusk of every elephant they kill. They have no swords, but hunt with spears on ponies. Beyond these people to the west dwell the Adari and Wuragi tribes, also belonging to the Arusi Gallas, while near Wubarak the Guragues were met with. Captain Wellby was about to continue his journey *viâ* Kambat, which place he expected to reach in two days.

The Foureau-Lamy Expedition across the Sahara.—In spite of rumours of disaster, the latest news seems to show that the persevering attempts of M. Foureau to cross the Sahara south of Algeria are likely to meet with success. The explorer, with whom is associated Count Lamy as military commander of the expedition, has communicated to the Paris Geographical Society two letters, written in January, and giving details of his experiences down to the 26th of that month (*Revue*

Française, 1899, p. 210 [*]). A telegram has also been received, bringing down the news to February 11. Early in December the expedition had reached the northern edge of the Tassili (plateau) of the Azjer, after a halt at Temassinin, which was to serve as the base for the further advance. On January 6, the date of M. Foureau's first letter, the party were in lat. 25° 19′ N., the Tassili having been safely crossed, though not without difficulty. Its western portion is known as Tindesset, and here the expedition was for five days passing across the limestone plateau, which reached a height of 5700 feet. The basin of the Igharghar had not yet been left. The surrounding region was essentially volcanic, a granite formation following immediately after the limestone. Towards the east lay an elevated *massif* named Adrar. On January 20 lat. 23° N. had been reached, at the post of Tadent, on the caravan route from Ghat to Air. The water-parting between the Mediterranean and the Atlantic had been crossed on January 9, at an altitude of 4690 feet. From Tadent a visit had been paid to the scene of the massacre of the Flatters Mission, but no remains of the unfortunate party existed. The well at which the massacre took place is named Tajenut, not Bir-el-Gharama, and lies 87 miles west-north-west of Tadent. On February 2 In-Azaua was reached, and the party was about to set out for Air. No aggression on the part of the Tuareg had been experienced.

Major Macdonald's Expedition.—A telegram from Mombasa on March 1 last announced the safe arrival at that place of Major Macdonald and his staff, on their return from the expedition through the northern parts of British East Africa. The Latuka country, east of the White Nile, seems to have been the furthest point reached by the main column, and this has been brought under British influence by a treaty with the king. Although compelled to join the Dervishes during the period of their power, he willingly embraced the opportunity of breaking with them. Captain Austin, whose work on Lake Rudolf was referred to in our March number, is said to have made a treaty with the Donjiro, whose territory extends beyond the 6th degree of north latitude. We have received various maps embodying the geographical results of the expedition, and hope to publish them on Major Macdonald's return.

Captain Bethe's Journey to the Ufumbiro Mountains.—The *Deutsches Kolonialblatt* for January 1 last contains the report of a journey made last year by Captain Bethe to the interesting volcanic region north-east of Lake Kivu. The German traveller advanced considerably to the north of Von Götzen's route, and his journey has resulted in geographical discoveries of some importance. Passing by the west end of Lake Mohazi, discovered by Von Götzen, Captain Bethe came upon a fine lake named Kifuha, surrounded by jagged mountains; the country here is named Bugira. Proceeding westwards across vast lava-fields, the party reached the volcano Kirunga-ya-Ufumbiro, which seems to be the easternmost of the line of peaks first seen by Captain Speke, and not the Kirunga of Von Götzen, of which the full name is Kirunga-cha-gongo. According to Captain Bethe, who ascended it, it reaches a height of between 13,000 and 16,000 feet, and will thus be considerably higher than the last-named peak (11,300 feet). The natives have built themselves dwellings beneath the lava-blocks, but have to fetch water from a distance, as the neighbourhood of the volcano is quite waterless. A small crater was found on the summit, and this was quite filled with water, which escapes by a subterranean channel. Some scanty springs on the mountain-side also send a subterranean stream to Lake Nyaburera, which in its turn sends its waters by a series of falls into Lake Nyaruhondo, which lies at 250 to 300 feet lower level. Captain Bethe thinks that the outflow of the latter joins the Nyavarongo. Turning east and south, and passing through a district inhabited by dwarfs, the expedition struck the Kagera near a wide lagoon formed by an expansion of its bed a little below the junction of the Nyavarongo and Akanyaru; then crossing the routes of Baumann, Ramsay, and others, it made its way, with some fighting, across the Ruvuvu and Luvirosa to Muyaga, at which place the White Fathers had arrived a few days previously. Thence Captain Bethe was hurriedly called to Ujiji by news of a threatened revolt of the Arabs, which, however, soon fell to the ground.

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[*] The earlier course of the expedition is described in the February number of the same journal (p. 94).

The Béhagle Expedition to Lake Chad.—The *Revue Française* for April announces that before November 19, 1898, M. de Béhagle had made two journeys to Bagirmi, in the course of which he had carefully surveyed the course of the Gribingi and that of the Shari as far as 10° north. He had also made a ten days' voyage on the Bamingi, above its junction with the Gribingi, and had explored several other streams. In the same journal it is recorded that M. Gentil has been appointed French Commissioner on the Shari, for the purpose of occupying Bagirmi and other parts of the basin of Lake Chad.

Railway Project for French Congo.—An expedition, under the command of A. Fourneau, was last autumn set on foot for the examination of a route suitable for a railway from Libreville to the Congo (*Revue Française*, April, 1899). Early in November the whole party reached Brazzaville, whence the leader set out on the 8th of that month for Wesso, on the Sangha. This was to form the rendezvous of the expedition, which was expected to unite there about the end of February.

German Expedition to the Sanga.—A German expedition for the exploration of the south-east corner of the Cameroons territory, on the Sanga river, set out at the end of last year, under the leadership of Dr. Pleyn. It is proceeding by way of the Congo, where it arrived in December. Dr. Pleyn is well provided with instruments for the astronomical determination of positions, and will begin work on the Ngoko, the western branch of the Sanga. The correct fixing of positions in this region is of importance with regard to the course of the boundary between the Cameroons and French Congo. A German expedition to Lake Chad has also been projected, but the idea seems at present in abeyance.

New Route to Karema, on Lake Tanganyika.—A journey from Bagamoyo to Karema was made in 1897 by Père Dromaux, of the "White Fathers," by a more direct route than any followed by previous travellers. A short account of the journey, with a map based on Père Dromaux's journal, is given by Paul Langhans in the first number of *Petermanns Mitteilungen* for the current year. The chief interest of the route lies in the second half, which led from Iseke, in Western Ugogo, through the districts of Ukimbu and Ukonongo, joining the routes of Prince and others (cf. *Journal*, vol. xii. p. 79) in the former, with those of Kaiser, Thomson, etc., in the west of the latter. Between Iseke and Itumba, the first sub-district of Ukimbu, the traveller crossed a long uninhabited stretch, in which water could everywhere be obtained by digging (in September), while in the wooded region on the frontier both water and game were found in abundance, the latter including antelopes, gazelles, etc., and even elephants. The chief place in Itumba lies on an elevated plain exposed to strong and cold winds, which blow from midnight to midday; the "tembes" are scattered over an area two days' march in diameter. Kiwele, too (separated from Itumba by an uninhabited tract), occupies a wide plain, with somewhat sandy and badly cultivated soil, though bananas are grown here and there. The cattle has much diminished, owing to the Wahehe raids. The female chief of Kiwele belongs to the people of Unyanyembe and many different languages are spoken, by reason of the number of slaves and adventurers who came into the land in the time of her grandfather; there are a few villages of Wangwana. The boundary between Ukimbu and Ukonongo, which has been hitherto indefinite, is placed by Père Dromaux at the Muangwa, a right-bank tributary of the Rungwa (basin of Lake Rukwa). The first district of Ukonongo reached was Kabuye, formerly conquered by Nyanga of Kiwele, but now re-occupied by its old chief, Kakuiko, who has built a new town at Ilunde, where his people cultivate some manioc and sugar-cane. In Magulu, likewise, the old trading-station Suke, visited by Kaiser in 1882, but since destroyed, has lately been rebuilt. Arrived at Mpimbwe, still forming part of Ukonongo, Père Dromaux turned southwards to visit Olelo, the chief town of the district, and the largest place seen by him since leaving the coast. The old chief Kasogea was in power so far back as the time of the murder of Captain Carter and Mr. Cadenhead by Mirambo's "Ruga-ruga." The Kafuu where crossed had no water on the surface, though higher up, in July, its bed was full, and crocodiles and hippopotami were seen. It unites with the Rungwa, which, contrary to previous reports, Père Dromaux considers to be the chief stream; its source is placed by him further east than on previous maps. The further route along the foot of the Fipa plateau led across a succession of difficult gullies, and a similar country was also traversed after the Tanganyika basin had been reached. The Kataui steppe, in the centre and north of Mpimbwe, becomes an impassable lake in the rainy season, and its soil is rich black humus. Amongst the results of the journey is the clearing up of the direction of Carter's last march, as well as the introduction of corrections as regards Thomson's route of 1880.

Survey of the Lower Limpopo.—During the Portuguese military operations in East Africa in 1895 a gunboat was sent up the Limpopo as far as the point known as Gungunhana's ford. Her commander, Lieut. de Andréa, took as careful a survey of the river as the circumstances of the campaign permitted, and has given a sketch of the results in the ninth part of the sixteenth series of the *Boletim* of the Lisbon Geographical Society, accompanied by a large-scale chart of the river. The reconnaissance was made in December, at the time of low water, and great difficulties were experienced in navigating the vessel. These began at the Ilha Verde in 24° 53½′ S. lat., where a passage was not effected until after eight and twenty hours' incessant toil. From this point to the lower end of Monleane island, in 24° 48½′, navigation was comparatively easy, but the river then soon began to get shallower. A little south of 24° 45′ two branches were seen; but that from the west, which continued the direction of the river below the junction, was soon found to be completely blocked. Lieut. Andréa thinks, however, that at high water it forms a continuous channel, giving a more direct passage than the eastern branch to the surplus water. The Changane, a tributary on the left bank a few miles higher up, proved to be navigable, though narrow; it flows immediately under Mount Chibuto. Above this, a little below Gungunhana's ford, the Limpopo was almost blocked by a bar of hard micaceous clay, and only after a long search was a channel discovered with 2½ feet of water. When the river is at its lowest, a fall probably occurs here. The ford itself is passable, as natives who were seen to cross by it were immersed up to the neck. From this point the gunboat was ordered to return, so that the reconnaissance could not be continued further. Lieut. Andréa thinks that the river will in the near future become an important channel of communication with the interior, for its bar is not now considered so dangerous as formerly. The high water-level rises at intervals of a few years more than 24 feet above that observed at the time of the survey; the whole plain bordering on the river-banks is then flooded.

The Austrian Expedition to Arabia and Sokotra.—We learn from Vienna that most of the members of the expedition sent out in September, 1898, by the Vienna Academy of Sciences for the exploration of Southern Arabia (*Journal*, vol. xii. p. 521), returned to the Austrian capital about the middle of April. A short communication on the results of the expedition has been made to the Imperial Institute of Geology in Vienna by the geologist of the party, Dr. Franz Kossmat, who reports that, in spite of the short time spent in Arabia, he has succeeded in making some interesting geological observations on the south coast of that country. More important results have, however, been obtained from the island of Sokotra, as well as from the small islands of Abd-el-Kuri and Samha,* lying between it and Cape Guardafui. Not only has Dr. Kossmat been able to construct the first geological maps of the islands, but he has made valuable additions to our knowledge of the topography of Sokotra, which is shown in its broad outlines only on existing maps. An interesting point mentioned is the fact that the districts on the islands which belong to the Cretaceous and Eocene formations, exactly resemble in morphological character the "Karst" lands of Austria.

The Tsetse Fly Disease.—Laboratory researches have lately been carried on, by a committee appointed by the Royal Society, for the purpose of throwing light on the Nagana or tsetse disease, and especially of discovering methods of prevention, cure, or immunization. Messrs. Kanthack, Durham, and Blandford, to whom the experiments were entrusted, have made a preliminary report on their labours down to August last, which is printed in vol. lxiv. of the *Proceedings of the Royal Society* (No. 404). So far the results have been mainly negative; but the work is being continued, and it is to be hoped that some method of dealing with the scourge may at length be discovered. The first experiments recorded deal with the susceptibility of different animals to the disease, a number of different species, from the smaller animals, such as dogs, rats, etc., to large animals like the horse, having been inoculated with diseased blood. In almost every case the disease was developed and proved fatal in a longer or shorter time. A bosch-bok died without showing any decided symptoms, but it was found that hybrids of zebra and horse, as well as of zebra and ass, were equally susceptible with other horses and asses. The writers consider that the experiments made by Koch on hybrids are inconclusive, as there was no proof that the animals were ever really infected. Guinea-pigs, though susceptible, proved more resistant than the other animals experimented on, while pigeons, the only birds yet tried, showed no signs of infection. Other points touched upon are the mode of infection, symptoms of the disease, and so on. Endeavours to produce immunity by inoculation in a variety of ways have so far proved entirely unsuccessful, nor have any means of cure or alleviation of the disease been discovered. Investigations into the life-history of the hæmatozoon, discovered in the blood of infected animals by Surgeon-Major Bruce, have led to no very complete results. The parasite is closely allied to the *Trypanosoma* present in the Surra disease of India, and, according to Koch, is identical; but this cannot be considered proved, though the diseases seem closely similar. The *Trypanosoma* discovered by Rouget in a horse in Algeria is also similar to that present in tsetse-fly disease, but the form occasionally found in English rats seems quite distinct. A full report will be published on the completion of the observations.

AMERICA.

Cartography of the State of Maryland.—The latest Report of the Maryland Geological Survey (vol. ii.) contains an important summary of the history of cartography of the state by Mr. E. B. Mathews, under the title of the "Maps and Map-makers of Maryland." Commencing with Ayllon's map of 1527, a description is given of the leading maps of the state, together with notices of the men who made the sketches and surveys for them. Many interesting facts are revealed by a study of the early maps, regarding the physiographical changes which have occurred in historic time along the Chesapeake and Atlantic coast-line. The early cartographical representation of the territory of Maryland is mainly devoted to the delineation of the shores and lands bordering on the Chesapeake and the Potomac. Captain John Smith, in his voyage up to the mouth of the Susquehanna, gained more information regarding the character of Chesapeake bay than did any of his successors. The features of particular value in the Smith map are the shores of Somerset, Dorchester, and Cecil counties, and the coast-line between the Patapsco and Point Lookout. The Lord Baltimore and Alsop maps, of 1635 and 1666, show some slight advance in knowledge; while the Herman map of 1670 for the first time presents an accurate delineation of the shore-line between Cambridge and Chestertown. Some slight knowledge was acquired during the middle of the eighteenth century regarding the regions of the Appalachians west of the Blue Ridge and the valley of the Shenandoah. Scarcely anything was known of the mountainous country lying at any distance from the north branch or the south branch of the Potomac. The map drawn by Fry and Jefferson in 1751 gives some information, but it was not until Griffith's map of 1794 was published that the knowledge acquired of the western portion of the state was rendered available. No attempt was made to delineate the inequalities of the surface until the inauguration of the work by Alexander and Ducatel, while little was attempted in the way of road traversing prior to the extensive surveys by Martenet. The following maps are mentioned as representing the most accurate cartographical information at the present time: the map now being issued by the United States Geological Survey, which covers a large area of the state; the charts prepared by the Coast and Geodetic Survey, representing the territory adjacent to and underlying the Chesapeake waters; while for the officially unmapped portions, the state maps published by Martenet are recommended, although stated to be at least ten years out of date. For the eastern shore of Maryland, as also for the northern portions of Cecil, Baltimore and Carroll counties, the early atlases published about twenty years ago are said to be the most accurate and detailed. The present Geological Survey, in co-operation with the U.S. Geological Survey, is rapidly reducing the unmapped portions of the state, and it is hoped that within a few years sufficient material will be to hand for an adequate representation of the physical geography of the state upon a large and uniform scale.

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* Named also Samneh, Sumlah, and Samleh on existing maps.

Richard Ludwig's Journey in Santo Domingo.—Prof. Sievers has done a service to geography by publishing in various German geographical journals the results of the extensive journeys of the deceased traveller, Richard Ludwig, in the countries bordering on the Caribbean sea. The latest instalment, dealing with Ludwig's travels in the island of Santo Domingo, appears in the *Zeitschrift* of the Berlin Geographical Society for 1898 (part 5). Born in 1849 at Waldmannshofen in Würtemberg, Ludwig applied himself in his early years to the calling of an apothecary, and after the Franco-German war, in which he took part, became director of a quinine factory at Munich. In 1883 he went out to Puerto Cabello on behalf of a guano syndicate, and spent the rest of his life in Venezuela and neighbouring countries, making constant journeys for the investigation of their mineral resources, and visiting many districts generally avoided by European travellers. Dr. Sievers himself accompanied him on one of the journeys, and bears witness to the trustworthy character of his observations, which relate to the botany, as well as to the general geological relations of the countries visited. Those made in Santo Domingo are of special value, not only on account of the scantiness of our information on the island generally, but because they shed new light on the structure of the island and its relation to other lands bordering on the Mediterranean sea of America. Ludwig made three principal journeys in the island, the first, undertaken in 1888, being the most important of all. It led from Santo Domingo along the coast to Azua, thence to the Laguna de Enriquillo, and northwards to San Juan and the upper Artibonite, in the great north-west plain. In returning, the traveller took a northerly route from Azua, which led across the higher inland ranges in the neighbourhood of Piedrablanca. On the second journey, he proceeded by sea to Sanchez, on the north-east coast, and thence made his way to Macoris, returning to Santo Domingo overland by way of Cotui; the most valuable result was the study of the northern range of the island, the Sierra de Monte Cristi. The third journey was mainly by sea along the south coast, the islands of Beata and Alta Vela being visited, and the latter proved to be due to recent eruptive agencies. Prof. Sievers gives detailed accounts of the journeys from the traveller's own notebooks, and ends with a summary of the conclusions to be drawn as regards the geological structure of the island, showing in particular the modifications to be introduced into Gabb's account of the same. The most important result is the proof that the island possesses a sub-structure of archaic rocks, which, in association with vast eruptive masses, can thus be traced both on the north and south, as well as, in part, on the east, of the Caribbean sea. The paper contains a large-scale map, showing Ludwig's routes and the mountain systems of the central part of the island; the distribution of crystalline schists, etc., being shown on an inset.

Mr. Hill on the West Indies.—Mr. R. T. Hill, of the United States Geological Survey, has written a comprehensive book on the West Indies,* treating each of the islands or minor groups in well-proportioned detail. Though the names of Cuba and Porto Rico appear more prominently in the title, these islands do not receive more space in the descriptions than their extent and importance justify. The book is appropriately dedicated to Prof. Alexander Agassiz, in appreciation of his important researches into the physical geography of the American Mediterranean. In his introductory sketch of the geographical position of the West Indies, Mr. Hill lays stress on the fact that North America lies on the whole to the west of South America, while Central America forms a west-to-east-running peninsula connecting the two. Stress is also laid on the fact that the high ground along the west coasts of North, Central, and South America is no proof of the existence of one continuous mountain range. There are distinct breaks in its continuity, and before the upheaval of Central America the northern and southern (or western and eastern) continents were connected by a continuous or nearly continuous land-bridge along the line of the Antilles. The system of the Andes, if continued, would be found to curve eastward and northward, while that of the Rocky mountains, if continued, would curve westward and southward, the two mountain systems running parallel and about 2000 miles apart. A third or Antillean mountain system runs between the two, with a prevailing west-to-east trend. On these three mountain systems due to great Earth-folds, volcanic mountains are parasitic, but their distribution is irregular. The general result, however, is that the Caribbean Sea is bordered on the east and west by volcanic chains, and on the north and south by fold-mountains. In classifying the islands according to their nationality, Mr. Hill points out that many of the islets and reefs, such as Aves and Roncador, are beyond the pale of any government, a fact which he explains either by their intrinsic worthlessness or by the fact that acknowledged ownership would involve expensive responsibilities, such as the placing of lighthouses. The general results are summarized in three chapters, on the Geological Features of the West Indies, Race Problems in the West Indies, and the Future of the West Indies. There are many excellent views, but the maps are few and not of the best quality. One fact of interest noted is that the Negro race has no tendency to increase in Cuba, as it does in the other islands of the West Indies. The 520,000 people of African descent, half of them mulattos, who lived in Cuba before the fatal effects of Weyler's policy began to act, are all that now represent the importation of over a million African slaves. Mr. Hill pays a high tribute to the organization and administration of the British West Indian islands.

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* 'Cuba and Porto Rico, with the Other Islands of the West Indies; their Topography, Climate, Flora, Products, Industries, Cities, People, Political Conditions, etc. By Robert T. Hill. London: T. Fisher Unwin. 1898.

AUSTRALASIA AND OCEANIC ISLANDS.

Annual Report on British New Guinea.—The last annual report of Sir Wm. Macgregor as administrator of British New Guinea, which has lately been issued as a Parliamentary paper, gives an account of the general progress of the possession during 1897–98, besides containing various reports on matters of scientific interest. The geographical matter is to be found chiefly in the reports of visits to little-known districts, some of which have already been published from time to time, and have been noticed in our pages. Another valuable contribution, however, is the large-scale map (6 miles to the inch) in four sheets, of the south-eastern part of the possession, which embodies the results of recent explorations in the whole south-eastern end of the island beyond the German frontier. It has been prepared under the direction of the Surveyor-General of Queensland. Some geographical items included in the report have apparently come to hand since the publication of the map. The latter shows, *e.g.*, the Yodda branch of the Mambare as occupying a great longitudinal valley running far to the south-east, but from a sketch-map showing the tracks cut by a prospecting party in this district, it seems that the upper course of the Kumusi (which enters the sea to the east of the Mambare in about 148° 15′ east) runs from south to north across the supposed line of that valley, which does not extend east beyond 147° 50′, the Yodda rising at the east end of Mount Parkes. A report of geographical interest not previously referred to is that by Mr. A. C. English, on a journey from the Rigo station to the eastern slopes of Mount Potter, near the sources of the Kemp-Welch river. It led across the Musgrave river by a very rough track over the spurs of Mount Bride. The Musgrave valley is reported as quite uninhabited, but the land on both banks is of excellent quality. In the neighbourhood of Mount Potter the Memai branch of the Kemp Welch river was reached; it is said to rise on the north-west side of Mounts Baron and Obree. The main branch is the Adai, which runs through the Nesbit valley, and is reported to be in flood all the year round. Among the appendices are to be found meteorological returns from Dogura, Port Moresby, and Daru; notes on Totemism; and reports on botany and mineralogy, including one by Mr. Hemsley on the alpine plants of the Owen Stanley range. The remarks by the administrator on the general condition of the possession are, on the whole, encouraging. The valuable results of the work of the missionaries are ungrudgingly recognized. Satisfaction is expressed at the increasing use by the natives of courts of law, and the progressive employment of natives during the last decade. During that time great progress has been made with the pacification of the country, and the examination of its resources can now proceed deliberately and continuously. The colony awaits agricultural development, which can only be effected by Europeans, and is, without doubt, the most pressing need of the country at the present time. It can be carried out, not only without detriment to the rights of the natives, but even to their positive advantage.

Dr. Von den Steinen's Visit to the Marquesas Islands.—The well-known German ethnologist, Dr. Karl von den Steinen, gave before the Berlin Geographical Society in December last an account of his visit to the Marquesas islands, made in 1897, for the purpose of collecting ethnological objects for the Berlin "Völkermuseum." From the point of view of ethnological science, such a collection from the most easterly outposts of the Polynesian race was of the first importance, not a single museum in the world possessing, previously to Dr. von den Steinen's visit, one in any way adequate to supply detailed information to students, while the knowledge possessed of the language, traditions, and mythology of the people of the group was very far from being complete. Leaving San Francisco by a sailing-ship of the line subsidized by the French Government, and experiencing some trial of patience while passing through the belt of calms, Dr. von den Steinen arrived, at the end of three and a half weeks, at the Bay of Taiohae, the chief port of the Marquesas. He made *en route* observations on the salinity of the sea-water, which gave results agreeing well with the curves on the official "Segel-Atlas." The Marquesas group, discovered in 1595 by Mendaña, and named by him in honour of the Marquis of Mendoza, Viceroy of Peru, consists of twelve islands, scattered roughly over 3° of latitude and 3° of longitude, and forming three groups in a line from north-west to south-east. Both physically and politically it forms a kind of dependency of Tahiti. Its scenery is uniform, and severe rather than beautiful. Of volcanic origin, the islands have no craters, but consist of massive felspathic rocks rising to a height of 4000 feet, with sharp central ridges, whence diagonal spurs run down to the sea, enclosing steep-sided valleys. The two principal islands are occupied by plateaux 1400 to 2000 feet in height, with steep ascent from the coasts. Vegetation is luxuriant in the deeper valleys and on the heights exposed to the trade winds, but elsewhere the slopes are treeless, but grassy. The main point of difference from Tahiti is the absence of fringing reefs and of level plains, which diminishes their agricultural value. Copra, cotton, and fungus are the chief exports, but coffee has lately been introduced. The settlements stretch from the shore for about 250 yards inland, and the inhabited islands have a population of little over one to the square mile. The entire alteration in the manners of the people under the influence of the missionaries made Dr. von den Steinen's researches into the primitive customs and traditions a work of great difficulty, and information was only to be obtained from aged survivors of a former generation. Among the points touched upon in this connection, the most interesting is that relating to the place of origin of the islanders and their traditional home, Hawaii (whence the Hawaian group had its name), whither the spirits of the departed are believed to return. Many authors have considered the place to be purely mythical, but Dr. von den Steinen is inclined to think it historical, and to identify it with Sawaii, the principal island of the Samoa group; for whereas Hawaii is always associated by the islanders with Vavau, Tonga, and Fiti (Fiji), the Samoa group would be left out entirely unless it were represented by Hawaii.

Pitcairn Island.—From the 'Correspondence' [C. 9148] recently issued regarding the condition of the Pitcairn islanders, we note the following particulars. Owing to the gradual disappearance of trees, which formerly grew all over the island, and the consequent washing away of the soil on the steep slopes, Pitcairn now presents a somewhat barren aspect. This loss of trees seems to have affected the climate of the island, as droughts now appear to be of frequent occurrence. There is still a large area of deep and fertile soil left in the valleys and on the hills in the interior. The island produces oranges, yams, and sweet potatoes, arrowroot, and coffee. The population, including children, numbers 141 souls—70 males and 71 females. The people are said to be fast degenerating through the effects of inter-marriage and over-population. It is thought that if regular communication with the island were established, it would go a long way towards correcting the present unsatisfactory state of affairs.

POLAR REGIONS.

Swedish Expedition to Bear Island.—Mr. J. G. Andersson, of Upsala, who accompanied Prof. Nathorst on his expedition last summer, is now preparing an expedition to Bear island. Prof. Nathorst, having found the geology of Bear island exceedingly interesting and worthy of a more minute survey than could be made last year, has encouraged Mr. Andersson to undertake the expedition, for which the Swedish Society of Anthropology and Geography has voted the balance of the Vega Fund. A contribution has also been given from "Lars Hiertas Minne" ("The Memory of Lars Hierta"), and the little amount which still rests will no doubt be obtained through private contributions. It is the intention of Mr. Andersson and his two fellow-naturalists to leave Tromsö in a steamer in the beginning of June. After having landed on Bear island with tents and provisions, they will remain there until the middle of August, when they will be fetched by one of the steamers going between Norway and Spitsbergen.

Arctic Expedition of the Duke of the Abruzzi.—During the present spring, the Duke of the Abruzzi has been pushing forward the preparations for his arctic expedition, on which he hopes to start during the early summer. He has purchased a Norwegian steam whaler, which has been altered to suit the object in view, and has been named the *Stella Polare*. It will be remembered that the prince's plan is to winter in Northern Franz Josef Land, and thence make an advance towards the pole during the spring of next year.

The Belgian Antarctic Expedition.—The anxiety which was beginning to be felt as to the fate of the Belgian antarctic expedition has been happily dissipated by a telegram announcing its return to Punta Arenas on March 28. The *Belgica*, under the command of Captain Gerlache, with a large scientific staff, sailed from Antwerp on August 16, 1897, and was last heard of in Magellan strait in December of the same year, when she left for the far south with the expectation of reaching an Australian port before winter. The *Mouvement Géographique* prints the following telegram from Captain Gerlache: "I regret to have to announce the death of Wiencke, on January 22, 1898, and of Danco, on June 5, 1898; otherwise all on board are well. The results are very satisfactory, and good collections have been made. We visited Hughes bay and Palmer Land, making a hydrographic reconnaissance of that district, collecting many specimens of rocks and landing on twenty occasions. We then steered for Alexander I. Land, and entered the pack to the west of that land; the extreme southerly point reached was 71° [illegible]' S. in 85° W. Obliged to winter; experienced a great deal of bad weather, but no intense cold except during September when the minimum temperature was 46° below zero Fahr. on September 8, 1898. Much drifted about by the wind, but got clear of the pack on March 14, 1899, and reached Punta Arenas on the 28th. Send letters to Punta Arenas." Lieut. Danco, of the Belgian Artillery, was in charge of the physical observations, and Mr. Wiencke was a Norwegian volunteer. Dr. F. A. Cook, who accompanied Mr. Peary on his expedition in 1891, and joined the *Belgica* as surgeon, telegraphed on April 4 to the Brooklyn Standard Union, announcing that the *Belgica* had reached Montevideo on that day on her way home, having abandoned the intention of returning to the antarctic regions. He states that the expedition was a complete success, the deaths were due to accident and disease. He also states that much new land was discovered in Weddell sea. It is scarcely probable that Captain Gerlache should have omitted to mention a visit to Weddell sea if the *Belgica* had cruised in those waters. His account of the route obviously implies that the ship kept to the west of Graham Land. The *Belgica* is the first vessel which has ever wintered in the antarctic ice, and no human beings have previously spent a winter in so high a southerly latitude as the ship's company of the *Belgica*. They followed very much the route of Bellingshausen in 1821, and Cook obtained his highest latitude about 300 miles further west than the *Belgica*.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

New Determination of the Pole of the Land-Hemisphere.—Although a large number of our atlases give maps showing the division of the globe into a land and water hemisphere, these have not hitherto been based on any exact calculation, but have often been drawn for the horizon of one or other of the capitals of North-Western Europe. The first attempt at a more scientific determination of the true pole of the land-hemisphere has been made by Dr. H. Beythien, who has lately published the results of his investigations in pamphlet form (Kiel & Leipzig: Lipsius & Tischer, 1898). For the object in view, he has made use of a method recommended in 1896 by Prof. Krümmel, and described in *Petermanns Mitteilungen* for 1898 (part 5). The first part of his paper, however, is taken up with historical notes on the origin of the idea of a land-hemisphere. The writer points out that a distinction must be drawn between "horizon-maps," or those drawn for the horizon of particular places, and those of which the true object has been the division of the globe into land and water hemispheres. Before the second voyage of Cook (1775) had given the first approximately correct idea of the distribution of land and water, any attempt to show the latter was necessarily based largely on guess-work; still attempts were made, and the earliest of these is considered by Dr. Beythien to be that of Buache in 1746, or several years before the publication of Boulanger's memoir (1753) to which Wisotzki has lately attributed the first mention of the idea. Other early maps are considered as merely horizon maps, though it is to be observed that Colson (1735), as quoted by Dr. Beythien, expressly states that his hemisphere, constructed for the horizon of London, exhibited "vastly the most considerable part of the whole Earth's superficies." The method employed by Dr. Beythien is as follows: It is at once seen that the chief land areas whose position in one or other hemisphere is doubtful are parts of South-East Asia and of South America. An antipodes map of these regions is therefore constructed on the gnomonic projection, in which all great circles appear as straight lines. That line which leaves the largest possible area of Asia on one side and of South America on the other will represent the bounding-line of the true land-hemisphere. For seventeen such lines, drawn so as approximately to fulfil the required conditions, Dr. Beythien has calculated the areas by means of Wagner's tables of one-degree squares. The result shows that the best line is that which gives as the pole a point just outside the mouth of the Loire, in 47¼° N., 2½° W. Of the poles corresponding with the ten best lines, not one falls in Southern England, where Ritter considered the point to lie, nine occurring in France or near the French shores, and the tenth in Catalonia. The point near Cloyes, recommended by Penck, takes the thirteenth place only, London the fourteenth, and Paris the fifteenth. For the known portions of the land and water hemispheres respectively, Dr. Beythien finds the proportion of water to land to be as 13 : 12 and as 14·4 : 1.

Influence of Wind on the Speed of Steamers.—The common phrase that steam-power makes vessels independent of wind or tide has perhaps unconsciously led landsmen, at least, to under-rate the influence exerted on the speed of powerful steamers by the direction and force of the wind. Herr L. E. Dinklage discusses in the *Annalen der Hydrographie* for January, 1899 (p. 34), the observations recently made on the North German Lloyd steamers *Werra* and *Fulda*, vessels of about 5000 tons and 15 to 16 knots, during a number of voyages across the Atlantic, between Gibraltar and New York. When classified according to direction and strength of the wind, the results show that when the wind was favourable, no difference whatever could be detected on the speed of the vessel during a light breeze or a strong gale. With a beam wind, however, a reduction of as much as 3·25 knots was noticed in the speed, from 15·7 knots with a light wind to 12·5 with a gale. Head winds naturally were still more serious hindrances to speed, the rate varying from 15·7 in a light breeze to only 10 knots in a gale. It is pointed out, of course, that other causes besides the force of the wind have to do with the reduction of speed; but fogs do not usually occur with strong winds, and a heavy sea is a direct consequence of the wind, so that the two may be classed as a common cause. It is not stated whether the vessels carried any sail. The obvious result of these observations is that the wind never helps a fast steamer when favourable, no matter how strong, but always hinders when unfavourable. Probably with vessels steaming 10 knots or less, a favouring gale might have some good effect.

Seismology.*—The growth of the science of seismology from the mere recording of earthquakes and their effects is well illustrated in this volume, the second which Prof. Milne has contributed to the International Science Series. In the advanced study of seismology which is now possible, the destructive violence of earthquakes is retiring into insignificance in comparison with the more frequent, and indeed almost continual, movements of a gentler type. Thus Prof. Milne commences with the discussion of bradyseisms, the slow and gentle movements of elevation or depression in the Earth's crust, and all the observations he has collected go to show that the surface of the Earth—the inalienable domain of the geographer—is neither fixed nor firm, but in a state of continuous flutter. It must, in fact, be looked upon as moving about a position of equilibrium disturbed by every redistribution of matter on the surface, by the movements of air and water no less than by the more massive lightenings and loadings of denudation and deposition, and the violent readjustments of volcanic eruptions. Prof. Milne shows how the normal tremor of the crust is related to the earthquake shock, and describes the various ingenious instruments by which the observations have been made. He gives instructive examples of the manner in which the style of architecture imported from stable lands into earthquake-shaken areas have been modified, and new styles introduced designed to resist destruction by seismic shocks. The practical applications of the science of seismology are indeed by no means the least important of the many interesting facts dealt with in the book.

GENERAL.

Honour to Sir John Murray.—The Council of the American Geographical Society of New York have awarded the Cullum Geographical Medal to Sir John Murray, in recognition of his many distinguished services in the cause of science. The medal bears the inscription, "Awarded to Sir John Murray, K.C.B., Naturalist, Deep-sea Explorer, Oceanographer, Editor of '*Challenger* Reports.' MDCCCXCIX." At the request of the American Geographical Society the medal will be presented to Sir John Murray by the American Ambassador at a meeting of the Royal Geographical Society.

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* 'Seismology.' By John Milne, F.R.S. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1898.

OBITUARY.

Commander F. G. Dundas, R.N.

We regret to record the death of Commander F. G. Dundas, well known to our readers for his pioneer work in East Africa, especially in connection with the navigation of the Jub, which he ascended with a light-draught steamer for the first time since the date of Baron von der Decken's unfortunate expedition. The deceased officer entered the navy in 1860, and after serving in various ships in the Mediterranean and elsewhere, was appointed to the command of the *Fervent* on the coast of England in 1874. He subsequently commanded the *Mallard* on the west coast of Africa, and afterwards served in harbour ships and in the coastguard. In 1890 he retired with the rank of commander, and in the following year was appointed commissioner and principal naval officer to the British East Africa Company. Before exploring the Jub, he had in this capacity done useful work by the ascent of the Tana to Mount Kenya. In 1893 he became superintendent of marine in the Niger Coast Protectorate, and afterwards held the post of naval adviser to the Chinese Government.

Dr. G. W. Leitner.

The well-known Oriental scholar and linguist, Dr. G. W. Leitner, died from pneumonia at Bonn, on March 22 last. Although subordinated to his other pursuits, his services to geography were by no means inconsiderable; his knowledge of the wild frontier districts between India and Afghanistan being particularly extensive, and, before recent events had thrown open those regions to a wider circle of inquirers, perhaps unrivalled. Gottlieb William Leitner was born at Budapest in 1830, and educated at Constantinople, Brussa, and King's College, London. During the Crimean war he acted as first-class interpreter to the British Commissariat, and afterwards became lecturer and eventually professor of Arabic at King's College. A few years later he went out to India as principal of the Government college at Lahore, and soon became warmly interested in the extension of education among the natives of the Punjab, where he succeeded in founding the Punjab University, besides doing much in other ways for the cause of education. In 1866 he was entrusted by the Punjab Government with a mission beyond the North-West frontier, which he carried out with success, the results being published as a Government memoir. His experiences at this time are also embodied in a subsequent work entitled 'Dardistan in 1866, 1886, and 1893.' On his return from India, he founded an Oriental institute at Woking. Dr. Leitner's studies embraced a wide range of subjects, and he is said to have been conversant with over twenty-five languages.

Mr. G. E. T. Smithson.

We greatly regret to announce the death, on April 10, from pneumonia following influenza, of the Secretary of the Tyneside Geographical Society, Mr. G. E. T. Smithson. Mr. Smithson, who was a Newcastle merchant much occupied with business affairs, devoted a very large part of his time to the management and development of the Geographical Society, which he had been largely instrumental in founding. In 1887, when the suggestion was put forward that a geographical society might be started in Newcastle, Mr. Smithson was the first to give his enthusiastic support to the proposal. It is mainly to his energy that the great success of the society and its strongly practical character are due. Originally established in small rooms, the society was enabled in 1890 to purchase the old Presbyterian church at Barras Bridge, which was converted into a geographical institute, and here the leading travellers and explorers have lectured to large audiences. Mr. Smithson was well known at the meetings of the British Association, which he rarely failed to attend, and always took an active part in the committee of Section E (Geography). He was also much interested in promoting relations between the Royal Geographical Society and the provincial societies. His death will be a serious loss to the society, which was so largely a reflex of his personality, and to the cause of geography in the north of England.

CORRESPONDENCE.

The Canadian Rockies.

On reading Prof. Norman Collie's paper, "Exploration in the Canadian Rockies," printed in the current number of the *Geographical Journal*, I notice that Mr. G. P. Baker, in commenting on that paper, refers to my own travels, in 1859, in the same regions, and remarks, "It is very difficult indeed to determine exactly where he (Lord Southesk) was; but, roughly speaking, he must have been in the neighbourhood of the headwaters of the Athabasca, journeying south to the Bow valley in a second parallel valley to the main range."

I believe that this will prove to have been the case, and my son, whose Australian explorations have recently been submitted to the Royal Geographical Society, has come to a similar conclusion—having applied the skill he possesses in laying down routes to laying down mine on Prof. Collie's map, using data supplied in my journal, as embodied in 'Saskatchewan and the Rocky Mountains,' and in the memory-sketch there (p. 234), in preparing which I had the advantage of some aid from Dr. Hector, a few years subsequent to my journey. My son thinks that the stream named on Prof. Collie's map, "Jonas creek," may very probably be that headwater of the Athabasca which was known to me as "Medicine Tent river" ('Sask.,' p. 193). If so, my entry to its valley might have been made near the junction of Prof. Collie's "Poboktan creek;" the fine mitre-peaked mass of "black slaty rock," which I named Mount Lindsay ('Sask.,' p. 193), being on my right as I descended a precipitous steep to gain the valley of the larger stream. The point marked "Jonas pass," might well represent (or lay near) the route I followed in crossing the divide into the Saskatchewan watershed.

Near that point my men and I erected a cairn on the top of an isolated hill of no great height ('Sask.,' p. 196). Referring to its position, I afterwards wrote, "There are two main valleys, . . . the former running north-west, the other south-east; the Medicine Tent river, an Athabasca headwater, running down the first, the North river, a Saskatchewan headwater, going down the second; the hill on which we placed the monument standing exactly at the central point where the two descents divide" ('Sask.,' p. 221). Here I may incidentally mention that when my eldest son was travelling in America a few years ago, he met at Banff (in the Rockies) a gentleman (whose name he has forgotten) who told him he had recently been among the mountains, and had seen "Southesk's cairn."

At p. 363 of the *Geographical Journal*, Mr. Wilcox states in his paper that "even the Stony Indians . . . know little of this river (North Fork)," as they do not visit that part of the country, believing that one of their tribe was "destroyed by an evil spirit." Whatever the reason, the whole district near the Medicine Tent river seemed to be utterly unfrequented, the only trace of a camp that we noticed, during many days, being a faint vestige, which one of my men (Klyne, a French half-breed) supposed to mark a visit to those parts made by his uncle, some thirty years before. Owing to that seclusion, the valleys on either side of my cairn were swarming with wild sheep, which, if not exactly tame, showed no signs of having been much disturbed.

The explorers of this district have generally entered it from the south and travelled northwards. In my own case the process was reversed, for, following the advice of Mr. Moberly, of the Hudson Bay Company's service, I "tracked up the McLeod river," and thence westward into the mountains some way to the south of "Jasper's House." "The highest peaks, he (Mr. Moberly) informed me, rose near the point at which I should in that case enter; and southwards thence to the head of the south Saskatchewan there extended about a ten days' march of country, which, as he believed, no European had ever seen" ('Sask.,' p. 167). In my journal I afterwards refer to the fact that Indians do not frequent that district: "Perhaps superstitious reasons may keep them away, as the name Medicine Tent river indicates magic and mystery. I am the first European who has visited this valley" ('Sask.,' p. 201).

One further remark may not be out of place. Among the many drawings and descriptions of Rocky Mountain scenery in the upper Saskatchewan and Athabasca regions, it has surprised me to find no record or mention of the singular and magnificent mountains seen by me in the country that probably lies to the east of Prof. Collie's "Jonas pass." Unlike the mountains of the Medicine Tent valley, those I refer to bore the character of vast mounds of *débris* crowned by enormous parallelograms of rock with perpendicular sides some 2000 to 3000 feet high. Mount Dalhousie (the frontispiece of my book) is one of these, but its summit showed a more castellated and broken formation than that of other mountains subsequently seen in the neighbourhood, one, in particular, "resembling an immense square block of masonry, placed on the summit of a vast mound with gradual slopes, like an altar raised by giants of old to some of the extinct gods" ('Sask.,' p. 223).

SOUTHESK.

April 13, 1899.

Hannibal's Pass.

It is with regret and a certain diffidence that I find myself compelled to dissent on a point relating to the Alps from the conclusions of my most indefatigable and learned friend, the Rev. W. A. B. Coolidge. His local and historical knowledge of the chain, and more particularly of the Western Alps, is, as he has reminded your readers, unrivalled in Europe. Yet I cannot but believe that, on further reflection, Mr. Coolidge will agree with Mr. Westlake and myself that for any profitable discussion of this old-world, but not worn-out, problem of "The Pass of Hannibal," something more is required than a thorough acquaintance with the localities and the classical texts. Surely, if we do not mean to waste our time, as so many have done before us, we must bring to the task historical insight as well as historical industry. We must remember that the "texts" were once the products of human beings. We must exercise our imagination so far as to realize who the authors were, what were their characters, and what the conditions in which they lived and wrote. Thus only shall we be able to form an opinion as to what conduct may, and what may not, reasonably be imputed to them. We shall further, using still the same method, be in a better position to decide what hypotheses are, and what are not, compatible with all we know of the characteristic energies of the Roman race.

If we set aside the text of Varro, there is little difficulty in making the Mont Genèvre fit the requirements of Livy. It is not "impossible," like the Little

St. Bernard. So far I am quite at one with Mr. Coolidge. But he does not venture to set aside Varro, and I must ask students to observe carefully to what a curious treatment of the Roman author's simple sentence he is forced to resort in order to introduce any doubt as to its meaning. For clearness' sake let me quote once more Varro's catalogue of the passes:—

"*Una*, quæ est juxtà mare per Ligures,

"*Altera*, quâ Hannibal transiit,

"*Tertia*, quâ Pompeius ad Hispaniense bellum profectus est,

"*Quarta*, quâ Hasdrubal de Galliâ in Italiam venit,

"*Quinta*, quæ quondam a Græcis possessa est, quæ exinde Alpes Græciæ appellantur."

This passage, as Mr. T. W. Arnold, in his valuable and impartial summary of the whole argument ('The Second Punic War:' Macmillan, 1886), has clearly perceived, is the substantial base of my argument. Mr. Coolidge, it is true, terms it "baseless;" but the expression, in this conjunction, it would seem, is "of little meaning, though the words are strong."

For what has Mr. Coolidge to offer by way of serious reply to my argument? He writes, "It is only a theory that the passes mentioned by Varro . . . are given in topographical order." It is, on the contrary, I submit, the only reasonable interpretation. For what does any other theory assume? That a Roman general who had himself conducted campaigns in the Western Alps, a Roman scholar whose reputation was that of "veterum omnium doctissimus" (Varro was both), framed his sentences either with childish clumsiness and carelessness, or with the intent to mislead, and set a puzzle for, posterity. Nor is the need of this perverse assumption the only difficulty in Mr. Coolidge's way. He cannot but admit that Varro's first and fifth pass, the Cornice and the Little St. Bernard, are in topographical order. He will hardly, I imagine, care to argue against the conclusion, generally accepted on weighty grounds, that the pass crossed by Pompey was the Mont Genèvre. Varro, he must probably allow, mentions the Mont Genèvre also in its proper topographical order. His only doubtful passes, then, are the second and fourth. Further, we have Pompey's own statement, in a letter to the Senate (Sallust, 'Hist.,' lib. iii.), that he took a different pass from Hannibal's. How, then, can Hannibal have crossed the Mont Genèvre? Pompey's allusion to Hannibal's pass is interesting as showing how well ascertained it was considered to be at that date.

Students, therefore, who are content to follow Mr. Coolidge, have to believe that Varro, the encyclopædist and librarian of Rome in the days of Cæsar, was not only loose in his statements, but also wrong in his facts.

Enough on this crucial point. I must turn to a subsidiary matter. Mr. Coolidge has a right to urge that, apart from the text of Varro, the evidence of the use of the Mont Cenis (or some pass from the Dora Riparia valley to that of the Arc) by the Romans is "inconclusive." It is so to this extent: we possess no direct proof from monuments or documents. It is arguable that Cæsar's short cut, when he hurried to intercept the Helvetii, was not by way of the Maurienne (see *Alpine Journal*, No. 81). But we have proof that a pass in this direction was in constant use as early as the sixth century, and had by that date superseded the Mont Genèvre as the main road between France and Italy.

In order to prevent this discussion from drifting into disputable details, I will not repeat here, or even on the present occasion ask your readers to attach any weight to, the arguments drawn from the writings of earlier and local writers which I cited in the *Alpine Journal* (No. 81) as supplying indications of the existence of a road over the Mont Cenis in Roman times. For my present purpose, I am satisfied if I can show that there was constant intercourse between Susa and the Maurienne in the sixth century. The inference I am content to leave to the common sense of geographers. Our authority for the communications across this part of the Alpine chain at that date does not seem open to any reasonable question. It is a papal bull. In volume sixteen of the *Gallia Christiana*, students will find the legend of the foundation of the See of the Maurienne, as well as its early history. In the middle of the sixth century, Tigris, a pious lady of the Maurienne, *was in the habit of receiving strangers and pilgrims.* Amongst her guests were a company of Scottish palmers from the Holy Land, who fired the good lady's imagination by tales of where the relics of St. John the Baptist were to be found to such good purpose that she set off for the East, and succeeded in recovering a thumb and depositing it in a church on the spot since known as St. Jean de Maurienne. Gontran, King of Burgundy, thereon founded a bishopric of the Maurienne (A.D. 562). This date is generally accepted. So far the legend told at length in a tenth-century MS., preserved in the National Library at Paris, and contemporaneously by Gregory of Tours in his 'De Gloriâ Martyrum,' c. 13.* After A.D. 562 we come on more solid ground. In A.D. 596 Gregory the First addressed to Theodoric, King of Burgundy, and Theodebert, King of Austrasia, a Bull complaining that the See of Turin had been materially curtailed and injured by the establishment of the Maurienne bishopric. It would seem that the valley of the Arc had been under the ecclesiastical jurisdiction of Turin till the latter part of the sixth century, and that subsequently Susa came under the bishopric of the Maurienne. Anyhow, the papal remonstrance failed to have any effect, and 130 years later we find the great monastery of Novalese founded with the consent "pontificum et clericorum nostrorum Mauriennatæ et Segusinæ civitatum," and that the same bishop was enthroned in the churches of St. John the Baptist of the Maurienne, and our Lady of Susa.

It can hardly be needful to point out the importance of these records for my purpose. They indicate a long-established and frequent use of one or more of the passes connecting the valleys of the Arc and the Dora Riparia at an early period. In my opinion, however, such documentary evidence as we possess on this matter is not essential. It is surely hard to believe that one of the principal and, from the East, most conspicuous gaps in the Western Alps, where the chain sinks into broad and rich pastures—the *Alpes in Cenisio* of early documents—was unknown to the neighbouring tribes.† It is wholly inconceivable to me that the practicable pass which from Carlovingian times onwards has been the most frequented in the Western Alps—a pass lying within a morning's walk of a flourishing Roman town (how flourishing Susa was is amply shown in Mommsen's 'Corpus Inscriptionum,' vol. v.)—was undiscovered and unused by its inhabitants. Such a supposition, I venture to think, is entirely contrary to the genius of the Roman race. Neither the silence of the surviving Itineraries as to the Mont Cenis (and its variations), nor the failure, up to the present time, of local antiquarians to produce any milestones from it, can overcome, or even shake, my conviction on this point. No doubt for some centuries the Mont Genèvre was the main high-road over the Western Alps. But that there was no known passage to the valley of the Arc is more than I can believe.

I am quite prepared, however, to be told that I place imagination in the place of fact; that all I prove thereby is that I have not the frame of mind, or the method, requisite to render my opinion of any value on a matter proper to antiquarians. Possibly, however, my experience as a traveller has given me one advantage over some more learned disputants. I can refer to a parallel case. Substituting Russians for Romans, the Caucasus is—or rather has been during the last half-century—very much in the position of the Alps at the beginning of our era. Besides the great high-road, there are several passes over the chain not furnished with stations or verst-posts, or indicated in general maps of the empire, yet well known locally and freely used. There are also passes which Russian forces have traversed which have not been converted into roads. I may cite as specific instances of each class the Klukhor and the Marukh (see *Petermann's Mitteilungen*, No. 12, 1898, with regard to the latter pass).

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* See also the 'Eclaircissements et Observations,' pp. 399–407, of Bordier's edition of the works of Gregory of Tours. Paris: Renould & Cie., 1857.

† Simler has some very sensible and apposite remarks bearing on this point in the chapter on Passes in his 'De Alpibus Commentarius,' A.D. 1574.

After all, the possibility of Hasdrubal having crossed the Mont Cenis does not in any way depend on the date of the establishment of a high-road over it by the Romans or their successors. Nature made the pass, and since the mountains were brought forth there has been a practicable gap in them at this spot ready for human use.

Before leaving this branch of the subject, the claims of the Mont Cenis to have been a Roman pass, I may refer students to a monograph of sixty pages by Prof. Dr. Osiander, 'Der Mont Cenis bei den Alten' (Cannstatt, 1897), which contains all—and much more than all—that can properly be urged in support of the antiquity of the pass. The learned writer, while citing a mass of interesting authorities, seems to me to pervert the well-known classical texts in a quite inadmissible fashion in order to force them into accordance with his own views. In my opinion he has injured a good case by unsound arguments, and I am sorry to have him for a supporter on this point. On the main question, however, we are at variance. He conducts Hannibal over the Mont Cenis.

In his second comment on Mr. Westlake's note, Mr. Coolidge has been somewhat hasty, and has consequently misunderstood the argument. "The Pass of the Argentière" is obviously used by Mr. Westlake (as it was used by Brockedon in his classical 'Passes of the Alps') as a term covering all the part of the route that lies in the mountains down to the point where it quits them. San Dalmazzo lies "at the foot" of the pass in the same sense that Chiavenna, Bellinzona, Domo d'Ossola, and even Verona are said to lie at the foot of the Alpine passes. Mr. Coolidge himself ('Alpine Guide,' chap. 1, rte. A.) describes San Dalmazzo as "a large village at the *very foot* of the mountains." The "rich plains" referred to by Mr. Westlake are those that lie parallel with the mountains between Borgo San Dalmazzo and Turin, a distance of 60 miles. His point, of course, is that these afford space, and the 7 miles of plain between Rivoli and Turin do not, for the successive incidents described by the historians.

Mr. Coolidge's reference to Prof. Fuchs' "small tractate" also requires some correction. That closely printed volume of 152 pages is "based on personal investigations on the spot" as regards the Mont Genèvre. But I can find in it no sign that the author has considered the text of Varro, or has ever visited, or even heard of, the Col de l'Argentière (which he calls on his map the Col della Maddalena); while so far is he from "having a full knowledge of all the (modern) literature," that he has not referred to Prof. Schiller's, Mr. T. W. Arnold's, or my own writings* on the subject. Moreover, he constantly speaks of "the English" collectively as partisans of the Little St. Bernard, as if the late Mr. Ball, Mr. Bunbury, and Prof. Bonney had never expressed the contrary view.

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* 'Berliner Philologischer Wochenschrift,' June, 1884; 'The Second Punic War' (Macmillan, 1886); *Alpine Journal*, vols. xi. and xiii., Nos. 81 and 93; and *Proceedings R.G.S.*, October, 1886.

I have not, I readily admit, Mr. Coolidge's detailed knowledge of the more obscure passes of the Western Alps. But I fail to see that a complete or partial acquaintance with impossible passes is any additional qualification for deciding which of the possible passes was used by the Carthaginian army. Mr. Coolidge's convictions are always forcibly expressed, interesting, and worthy of full consideration, but he must pardon me for saying that they do not present themselves to me as conclusive for the rest of the world. I have myself crossed all the five great passes which now, as in Varro's days, unite Gaul and Italy. I see no reason to modify the opinion I came to sixteen years ago. We cannot ourselves prove which pass Hannibal crossed; but we can show where the best informed Romans of Cæsar's time knew, or thought they knew, him to have crossed.

Finally, should Mr. Westlake, or any other reader, accept Mr. Coolidge's invitation to refer to his new edition of the 'Alpine Guide,' he will, I think, find much comfort and support in the following sentences. Mr. Coolidge there writes (section 3, rte. A., Western Alps): "It was the passage of Francis I. in 1515 with a large army that first brought the Col de l'Argentière into historical prominence. It was later traversed by French and Spanish armies in 1692, 1710, and 1744. Napoleon ordered a road to be made over it bearing the proud title of 'Route Impèriale de l'Espagne en Italie;' and even now (though that project has not yet been fully carried out) it is styled the road 'from Montpellier to Coni' (Cuneo). It is, perhaps, the gentlest and easiest pass in the whole of the Western Alps, and has been compared to the road between Keswick and Ambleside."

It follows from these statements, that the physical features of the country are consistent with the Roman belief that the Col de l'Argentière was crossed by Hannibal, that the pass is the most natural route from Spain to Italy for an army and that several armies have used it, meeting on the way with adventures and difficulties coinciding in a very remarkable way with those attributed to Hannibal (see my paper, *Alpine Journal*, No. 81). All this we find established on Mr. Coolidge's own showing. The advocates of the Col de l'Argentière could hardly have hoped for such powerful testimony to the strength of their case from a sturdy opponent.

It may, perhaps, be agreeable to those readers who are familiar with the almost fabulous pertinacity in argument which characterizes the majority of the disputants in this matter, if I assure them that I do not propose, under any provocation, to intrude my own views on their patience any further in these pages. An English writer of authority has, I find, been lately kind enough to speak of my early papers, an analysis of which appeared in the Society's *Journal*, as "epoch-making!" So handsome a compliment may possibly justify me in revising and re-issuing them in a separate form at some future date.

Douglas W. Freshfield.

Ophir.

Though Dr. Schlichter is very likely right in his contention that Ophir was not in India, I venture to think that the grounds on which he has arrived at his conviction will scarcely stand examination. Bearing in mind what we know as to the actual facts at a later period of the history of India, it seems impossible to admit the trustworthiness of Arrian's account of the scarcity, or absence, of gold in those provinces which came under the observation of Alexander and his companions; not to mention that Q. Curtius has quite a different story to tell. We read that a thousand years after the Greek expedition, Arab conquerors found in the Panjab, and in that very capital of the Malli which Alexander so gallantly stormed, and where he so nearly lost his life, an immense treasure of gold (gold-dust). Muhammad bin Qasim, the Arab leader, is reported to have sent to Iráq 120 millions of *dirhams*, by far the greater part of which must have been derived from the spoils of Multan. Another account puts the Multan treasure at 40 *buhár*, a vague measure which sometimes meant a camel-load, but the same writer, expressing the amount in different terms, calls it 2,397,600 *mithqál* (a gold coin said to weigh 1½ dram). We may make large allowance for Eastern exaggeration and yet fairly conclude that the quantity of gold found in this one temple treasury was enormous. No doubt vast changes, economic as well as political, may occur even in Asia in the course of a millennium, but we cannot, I believe, gather either from tradition or recorded history, anything to favour the supposition that gold flowed into India in abnormal amount in the interval between the Macedonian and the Arab invasions. On the contrary, the facts of which we have sufficient evidence—the absence of settled and vigorous government, the frequent invasions and harryings of the regions in which Multan itself formed a central point, during the period in question—must convince us that the accumulation of gold where it was formerly unknown is not to be thought of as possible.

Not much can be gained from the study and comparison of the place-names involved in the Ophir controversy. The mysterious port or region is called in Genesis Ophir, and in later books of the Old Testament Ophír (*i* long). The LXX. transliterated Σωφηρα, Σωφειρα, Ωφειρ, and in one place the Alexandrine Codex has Σωφαρα. The last variant agrees closely with Sofala, but equally closely with Súpárá, north of Bombay, an emporium of great antiquity, which was flourishing centuries before Zimbabwe came into existence, supposing Dr. Schlichter's date for the latter's foundation to be correct. As for Lassen's identification of Ptolemy's Αβιρια with Ophir, it is sufficient to recall the fact that Ptolemy places that district north of Patalene, or the Indus delta region—that is, at a considerable distance from the sea—to put it out of the question. Any place in Arabia seems to be excluded by the length of the voyage, which is postulated as a condition in the controversy, otherwise Ophír near Sohár, in the province of Oman, would be suitable, for though none of the articles mentioned as forming part of Solomon's cargoes were of Arabian production, all might have been found in an Arabian port.

Nor, again, can anything conclusive, as between Africa and India, be derived from a consideration of the length of the voyage. Keeping in mind the fact that the navigation of the time was still in the stage of coasting (Hippalus being still in the womb of the distant future), it is clear that a voyage from Ezion Geber to any port in Southern India would take as much time as one to Sofala.

I venture to think that Dr. Schlichter should apply himself to the refutation (if that be possible) of Josephus' express statement that Solomon sent his men "to the land that was of old called *Ophir*, but now the *Aurea Chersonesus* which belongs to India;" and should also take into consideration the fact that Coptic lexicographers have declared "Ophir" in their language to mean India. Very likely Josephus, though learned, was not profound in geography, but it is not at all improbable that he had inherited a truthful tradition. Also both he and the Copts perhaps spoke of India much as people used to speak of "The Indies," which might or might not include India proper. At all events, if Josephus knew anything about it, Ophir was in the Malay peninsula or thereabouts.

M. R. Haig, Major-General.

April, 1899.

P.S.—Dr. Schlichter is quite correct in saying that El Mas'udí mentions Sofala. He speaks of it in connection with the people called *Wáq Wáq*, and says it produced abundance of gold.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898-99.

Eighth Ordinary Meeting, March 27, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Alexander d'Abaza; Andrew Walker Bell; C. R. S. Cadells; Wm. Young Campbell; George Drury Coleman; George Griffin Eady; William Mason.*

THE NATIONAL ANTARCTIC EXPEDITION. MR. L. W. LONGSTAFF'S DONATION.

After the statement made by the President which was published in the April number of the *Journal*, the PRESIDENT said: We are honoured this evening by the presence of Lord Lister, President of the Royal Society, who will wish also to say a few words on the munificence of our associate.

Lord LISTER: It gives me peculiar gratification to be present this evening, on which the President of the Geographical Society has made an announcement which has pleased you all so much. The Royal Society has, of course, taken a deep interest in the project of an antarctic expedition, but the funds at her disposal for scientific purposes are but slender, and she has been able to do not much in that line. The Geographical Society, as a Society, has done more, and your President deserves the thanks of us all for his energetic and successful efforts, crowned as they have been by the acquisition of this splendid donation you have heard of. A British Antarctic Expedition is now assured, and the disgrace that would have been attached to this country if she had not risen to the present important occasion, is prevented.

I need hardly say how deeply grateful all of us feel to the donor of this great gift. I must confess that it is to me a matter of satisfaction that he is the son of a distinguished member of the medical profession. I don't know whether Lord Iveagh's magnificent gift to the Jenner Institute of Preventive Medicine can have had any influence in suggesting to Mr. Longstaff that he might do likewise. We can only hope that donations of this splendid kind for the furtherance of science will be abundant in the future.

We cannot expect our Government to do very much for us in the aid of science; but so long as we have such donations from private individuals, science will get on very well. It only remains now to endeavour to induce the Government to aid the expedition, the full expense of which, whether rightly or wrongly, they did not feel prepared to undertake.

I cannot sit down without congratulating the Geographical Society on the splendid success they have attained.

The PRESIDENT: I am sure, after what you have heard, you will wish to pass a cordial vote of thanks to Mr. Longstaff for his munificent gift, and you will be glad that I should inform him of your vote.

The Paper read was:—

"On Kumatology." By Vaughan Cornish, Esq.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By **HUGH ROBERT MILL**, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria. *Z. Ges. Erdk. Berlin* **33** (1899): 555–366. **Richthofen.**
Die neue geologische Karte von Oesterreich. Von F. v. Richthofen.

Austria—Bukovina. *Globus* **74** (1898): 381–387. **Hormuzaki.**
Aus dem Gebirge der Bukowina. Landschafts und Vegetations-Skizzen. Von C. Frhrn. v. Hormuzaki. *With Illustrations.*

The illustrations are from sketches. A notice appears in the *Journal*, p. 529.

Austria-Hungary—Carpathians. **Dénes.**
Jahrb. Ungar. Karpathen-V. **25** (1898): 121–143.
Die neue Originalkarte der Hohen-Tátra. Von Franz Dénes.

Austria-Hungary—Carpathians. **Filarszky.**
Jahrb. Ungar. Karpathen-V. **25** (1898): 30–91.
Das Pieninen-Gebirge und seine Flora. Von Dr. Ferdinand Filarszky.

Azores. *Tour du Monde* **4** (1898): 625–636. **d'Espagnat.**
Aux iles Açores. Par M. Pierre d'Espagnat. *With Illustrations.*

Balkan Peninsula. *Deutsche Rundschau G.* **21** (1899): 193–206, 255–266. **Meinhard.**
Auf Transbalkanbahnstudien. Von Friedrich Meinhard. *With Illustrations and Map.*

Belgium. *Globus* **75** (1899): 21–24. **Kellen.**
Arel, eine deutsche Stadt in Belgien. Von Tony Kellen. I.

Bulgaria—Rila Mountains. *Scottish G. Mag.* **15** (1899): 86–92. ———
The Rila Mountains.

Denmark—The Sound. **Lönnberg.**
Undersökningar rörande Öresunds Djurlif. Af Dr. Einar Lönnberg.—Meddelanden från Kongl. Landtbruksstyrelsen. No. I. år 1898. (No. 43.) Uppsala, 1898. Size 9½ × 6½, pp. 78. *Map.*

An account of the biological conditions of the waters of the Sound, with lists of species.

England and France. *Sitzb. A. W. Berlin* (1898): 859–892. **Lohmann.**
Die Amtliche Handelstatistik Englands und Frankreichs im xviii. Jahrhundert. Von Dr. Friedrich Lohmann.

Europe—Continental Shelf. *Geolog. Mag.* 6 (1899): 16–18. **Spencer.**
Prof. Hull's 'Submerged Platform of Western Europe.' By Prof. J. W. Spencer. Also letter by Rev. Osmond Fisher, pp. 56–57.

Europe—Geodesy. **Weiss and Schram.**
Publicationen für die Internationale Erdmessung. Astronomische Arbeiten des k. k. Gradmessungs-Bureau ausgeführt unter der Leitung des Hofrathes Theodor v. Oppolzer. Nach dessen Tode herausgegeben von Prof. Dr. Edmund Weiss und Dr. Robert Schram. X. Band. Längenbestimmungen. Wien: F. Tempsky, 1898. Size 12½ × 10, pp. 286. *Presented by the K. K. Gradmessungs-Bureau in Wien.*

Contains a number of determinations of time-intervals between important continental observatories.

Faroe Islands. *Die Natur* 47 (1898): 519, 529, 543, 555, 567, 583. **Lorenzen.**
Die Fär-Öer. Nach J. Lomholt in "Nord og Syd." Von A. Lorenzen.

Germany. *Globus* 75 (1899): 89–96, 108–114, 143–149. **Tetzner.**
Die Kuren in Ostpreussen. Von Dr. F. Tetzner. *With Map and Illustrations.*

On the people of Russian Kurland now concentrated on the long narrow sandspit of the Kurische Nehrung.

Germany. **Ratzel.**
Deutschland. Einführung in die Heimatkunde. Von Friedrich Ratzel. Leipzig: F. W. Grunow, 1898. Size 7½ × 4½, pp. viii. and 332. *Maps and Illustrations. Price* 2*s.* 6*d.*

The author writes with the object of deepening the knowledge of Germany amongst the people of that country, and he points out that this can only be done satisfactorily by demonstrating how closely the life of the people depends on the character of the land.

Germany—Alsace. **Reuss.**
L'Alsace au dix-septième siècle au point de vue géographique, historique, administratif, économique, social, intellectuel et religieux. Par Rodolphe Reuss. Tome Deuxième. Paris: E. Bouillon, 1898. Size 10 × 6½, pp. xii. and 638. *Price* 16*s.*

Germany—Commercial Geography. **Gastrell.**
Development of Commercial, Industrial, Maritime, and Traffic Interests in Germany, 1871 to 1898. Foreign Office, Miscellaneous, No. 490, 1899. Size 10 × 6½, pp. 72. *Price* 1½*d.*

This is a valuable chapter on the Commercial Geography of Germany, sketching the great strides of advance which have been made since the foundation of the empire.

Germany—Hiddensöe. *Globus* 75 (1899): 9–14. **Seidel.**
Spaltenbildungen und Landverlust auf Hiddensöe. Von H. Seidel. *With Map and Illustrations.*

On the loss of land on the Baltic island of Hiddensee on the west side of Rügen.

Germany—Meteorology. ——
Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1898, zugleich Deutsches Meteorologisches Jehrbuch für 1898 Beobachtungssystem des Königreichs Preussen und benachbarten Staaten.—Veröffentlichungen des k. Preussischen Meteorologischen Instituts 1898, Heft 1. Berlin: A. Asher & Co., 1898. Size 13½ × 10.

Germany—Meteorology. ——
Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1894, zugleich Deutsches Meteorologisches Jahrbuch für 1894 beobachtungssystem des Königreichs Preussen und benachbarten Staaten.—Veröffentlichungen des königlich Preussischen Meteorologischen Instituts. Herausgegeben durch dessen Direktor Wilhelm von Bezold, 1894, Heft III. Berlin: A. Asher & Co., 1898. Size 13½ × 10. *Map. Presented by the K. Preussischen Meteorologischen Instituts.*

Germany—Schleswig. *Globus* 75 (1899): 53–54. ——
Die Nationalitätsverhältnisse in Schleswig. *With Map.*

The map shows the districts in which Frisian, Danish, German, and both German and Danish are spoken.

Germany—Silesia. **Hellmann.**
Regenkarte der Provinz Schlesien. Mit erläuterndem Text und Tabellen. In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. Berlin: D. Reimer, 1899. Size 10½ × 7, pp. 24. *Map. Presented by the German Meteorological Institute.*

Historical. **Rey.**
Le Royaume de Cottius et la Province des Alpes Cottiennes d'Auguste á Dioclétien. Par R. Rey. Grenoble: A. Gratier & Cie., 1898. Size 9 × 6, pp. 250. *Maps. Price* 6*s*. 6*d*.

Holland—Geology. **Cappelle.**
Mededeelingen omtrent de Geologie van Nederland, Verzameld door de Commissie voor het Geologisch Onderzoek. No. 23. Nieuwe Waarnemingen op het Nederlandsche Diluviaalgebied, voornamelijk met het oog op de Kaarteering dezer terreinen. Door Dr. H. van Cappelle. Verhandelingen der k. Akademie van Wetenschappen te Amsterdam. (Tweede Sectie.) Deel vi. No. 2. Amsterdam: J. Müller, 1898. Size 11 × 7½, pp. 24. *Plate.*

Notes on the boulder-clay deposits of Holland.

Hungary. *Die Natur* 47 (1898): 505–509. **Woenig.**
Die Pusztenflora des ungarischen Tieflandes. Studien-Skizzen von Franz Woenig. 4. Die Flora der Salz-Puszten, Salzseen, Salzlachen, und der Salzauswitternden Stellen des Bodens.

Iceland. *Z. Ges. Erdk. Berlin* 33 (1898): 283–301. **Thoroddsen.**
Untersuchungen in Island in den Jahren 1895 bis 1898. Von Dr. Th. Thoroddsen.

Italy. ———
Suggestions for Development of British Trade with Italy. Foreign Office, Miscellaneous, No. 499, 1899. Size 10 × 6½, pp. 20. *Price* 1½*d*.

Italy. **Magistris.**
Giovanni Marinelli. Le Provincie d'Italia. Provincia di Massa e Carrara di Luigi Filippo de Magistris. Roma: Società Editrice Dante Alighieri, 1898. Size 8 × 5½, pp. 20. *Presented by the Author.*

Italy. **Baedeker.**
Italy. Handbook for Travellers by Karl Baedeker. First Part: Northern Italy, including Leghorn, Florence, Ravenna, and routes through Switzerland and Austria. With 25 Maps and 35 Plans. Eleventh edition. Leipsic: Karl Baedeker; London: Dulau & Co. 1899. Size 6¼ × 4¼, pp. lxiv. and 540. *Price* 8 *marks. Presented by Messrs. Dulau & Co.*

Italy—Geology. *Atti R.A. Lincei, Rendiconti* 7 (2 Sem.) (1898): 326–330. **Lorenzo.**
I grandi laghi pleistocenici delle falde del Vulture. Nota preliminare di G. De Lorenzo.

Mediterranean. *Ann. Hydrographiques* (1898): 35–37. **Grenet.**
Remarques sur le régime des vents de la côte Nord de la Méditerranée. Par M. Victor Grenet.

Mediterranean—Alboran. **[Ludwig Salvator.]**
Alboran. Prag: H. Mercy Sohn, 1898. Size 13 × 10½, pp. viii. and 90. *Maps and Illustrations. Presented by the Archduke Ludwig Salvator.*

H.I.H. the Archduke Ludwig Salvator observes in his preface that probably no island in the world is seen by so many and visited by so few as Alboran. The island, which carries an important lighthouse, lies 100 miles east of Gibraltar, midway between the coasts of Spain and Marocco.

Mediterranean—Lampedusa. **Magistris.**
La pesca delle spugne nel mar di Lampedusa durante l'anno 1896. [L. F. de Magistris.] (Estratto dal Giornale Italiano di Pesca e Acqui-coltura, N. 1.—1898.) Size 10 × 7, pp. [4]. *Presented by the Author.*

Norway. **Dahl.**
Botaniske undersøgelser i Søndfjords og Nordfjords fjorddistrikter i 1896-97. Af Ove Dahl. Christiania, 1898. Size 9½ × 6½, pp. 72.

Norway. **Oppenheim.**
New Climbs in Norway. An Account of some Ascents in the Sondmore District. By E. C. Oppenheim. Illustrated by A. D. McCormick, and from Photographs. London: T. Fisher Unwin, 1898. Size 8¼ × 6, pp. x. and 258. *Price* 7*s*. 6*d*. *Presented by the Publisher.*

Describes mountaineering exploits which carried the author and his friends into some of the still almost unvisited parts of Norway.

Norway and Sweden. *Questions Dipl. et Colon.* 5 (1898): 409–412. **Koht.**
Norvège et Suède. Par Halvdan Koht.

Russia. *Globus* 75 (1899): 130–132. **Nehring.**
Gab es einst Wälder in der Kalmückensteppe? Von Prof. Dr. A. Nehring.

A discussion of the probable existence of woods in the Kalmuk steppe from the evidence of animal fossils. The paper is noticed in the *Journal* for April, p. 429.

Russia. **Toll.**
Geologische Forschungen im Gebiete der Kurländischen Aa. von Baron E. von Toll. Vorläufiger Bericht mit einem Anhange, Dr. Gunnar Andersson's Verzeichniss der Glacialpflanzen von Tittelmünde enthaltend. (Separat-Abzug aus den Sitzungsberichten der Naturforscher-Gesellschaft bei der Universität Jurjow (Dorpat). Jhrg. 18.) Size 8½ × 5½, pp. 34. *Presented by the Author.*

Spain. *Deutsche Rundschau G.* 21 (1898): 103–108. **Nebehay.**
In Baskenlande. Von Karl Nebehay. *With Illustrations and Plans.*

A visit to the north of Spain, including Bilbao and San Sebastian.

Spain—Llivia. *A travers le Monde, Tour du Monde* 5 (1899): 21–22. ——
L'Enclave de Llivia. *With Map.*

Llivia is a small *enclave* of Spanish territory in the French department of Pyrénees Orientales, with a neutral road about a mile in length, connecting it with the main body of Spain.

Switzerland. *Mouvement G.* 15 (1898): 607–612. **Wauters.**
Le Chemin de fer du Gornergrat. *With Illustrations.*

United Kingdom. *J. School G.* 2 (1898): 361–369. **Buchan.**
The Temperature of the British Isles. By A. Buchan, LL.D.

ASIA.

Asia—Historical. *Sitzb. A. W. Berlin* (1898): 824–843. **Köhler.**
Das asiatische Reich des Antigonos. Von Ulrich Köhler.

China. ——
China. Imperial Maritime Customs. II.—Special Series: No. 2, Medical Reports, for the half-year ended March 31, 1898. Shanghai. London: P. S. King & Son, 1898. Size 11 × 9, pp. vi. and 58. *Diagrams and Illustrations.*

China. ——
China. No. 1 (1899). Correspondence respecting the Affairs of China. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. xxiv. and 360. *Price 3s.*

This Bluebook contains the correspondence of the Foreign Office relating to Chinese affairs from March 29, 1898, to February 3, 1899, in all 473 documents.

China. *Questions Dipl. et Colon.* 6 (1899): 83–87. **Fauvel.**
Les Télégraphes et les Postes en Chine. Par M. A. A. Fauvel. *With Map.*

China. *Deutsche Rundschau G.* 21 (1899): 220–223. **Karsten.**
Ein Blick in das Industrieleben Chinas. Von Paula Karsten.

Chinese Empire—Tibet. *Oesterr. Monats. Orient.* 24 (1898): 135–138. ——
Landor's Reise in Tibet.

Chinese Empire—Turkestan and Tibet. **Grenard—Dutreuil de Rhins.**
J. L. Dutreuil de Rhins. Mission scientifique dans la Haute Asia, 1890–1895. Deuxième Partie. Le Turkestan et le Tibet, étude ethnographique et sociologique. Par F. Grenard. Paris: E. Leroux, 1898. Size 11½ × 9, pp. 476. *Illustrations. Presented by the French Minister of Public Instruction.*

French Indo-China—Annam. **Lemire.**
Bijd. Taal-, Land- en Volkenk. Ned.-Indië 6 (1899): 76–86.
Excursion à Hué, capitale de l'Annam. Par Ch. Lemire.

French Indo-China—Tonkin. **Billet.**
Deux Ans dans le Haut-Tonkin (Région de Cao-Bang). Par le Dr. Albert Billet. Paris: A. Challamel, 1898. Size 10 × 6½, pp. lv., 326, and xliv. *Maps and Plates. Price 20s.*

This work was originally published in the *Bulletin Scientifique de la France et de la Belgique.* It gives a detailed account of the Cao-Bang district in all aspects, and supplementary chapters on the fauna and flora of Upper Tonkin. It represents two years of very arduous scientific work, concisely told.

India. ——

Report on the Madras Observatory for the year 1897-98, and on the Eclipse Expedition of January, 1898. Madras, 1898. Size 10 × 6½, pp. 30.

India. **Hunter.**

A History of British India. By Sir William Wilson Hunter, K.C.S.I., etc. Vol. i. To the overthrow of the English in the Spice Archipelago. London: Longmans & Co., 1899. Size 9½ × 6, pp. 476. *Maps. Price* 18*s*. *Presented by the Author.*

This first volume of a new and comprehensive history of British India commences with the closing of the old trade-routes to the East, recounts the quest for India by sea, and traces the history of the struggle of the Portuguese and Arabs for supremacy, the constitution of the first English East India Company, and the struggle with the Portuguese, and the volume ends with the tragedy of Amboyna in 1623.

India. *P.I. Civil Engineers* **134** (1898): 66–118. **Stoney.**

Extraordinary Floods in Southern India: their Causes and Destructive Effects on Railway Works. By E. W. Stoney. *With Plate.*

India—Andaman Islands. *J.S. Arts* **47** (1899): 292–305. **Temple.**

The Penal System at the Andamans. By Colonel Richard Carnac Temple.

India—Assam. **Home.**

Progress Report of Forest Administration in the Province of Assam for the year 1896-97. (From July 1, 1896, to June 30, 1897.) By A. L. Home. Calcutta, 1897. Size 13½ × 8½, pp. 98 and 4. *Map.*

India—Bombay Presidency. ——

Brief Sketch of the Meteorology of the Bombay Presidency for 1897-98. Size 13½ × 8½, pp. 16. *Diagram.*

India—Burma. *J. S. Arts* **47** (1899): 173–190. **Nisbet.**

Railways in Burma, and their proposed extension across Yunnan. By John Nisbet. *With Maps.*

India—Burma. **Pottinger and Prain.**

A Note on the Botany of the Kachin Hills north-east of Myitkyina. By E. Pottinger and D. Prain.—Records of the Botanical Survey of India. Vol. i. No. 11. Calcutta, 1898. Size 10 × 6, pp. 215–310. *Maps. Presented by Captain E. Pottinger.*

India—Burma. *M.G. Ges. Wien* **41** (1898): 664–705. **Schmitz.**

Burma, die östlichste Provinz des indischen Kaiserreiches. Nach englischen Quellen und eigenen Beobachtungen von. Dr. H. Schmitz. *With Map.*

India—Chitral. **Robertson.**

An Official Account of the Chitral Expedition, 1895. Compiled . . . by Captain W. R. Robertson. Calcutta, 1898. Size 13½ × 8½, pp. 94 and cxviii. *Maps and Illustrations.*

This important report includes a history of British relations with Chitral, as well as the detailed description of the proceedings of the relief expedition in 1895.

India—Corundum. **Holland.**

A Manual of the Geology of India. Economic Geology. By the late Prof. V. Ball, C.B. Second Edition, revised in Parts. Part I.—Corundum. By T. H. Holland. Calcutta, 1898. Size 10½ × 7½, pp. 80. *Maps and Plate. Price* 1*s*. 4*d*.

On the distribution of corundum in its common form valuable as abrasive material, and in its precious form as ruby, sapphire, and oriental topaz, with numerous maps and full particulars of the method of occurrence.

India—Railways. **Brereton.**

Administration Report on the Railways in India for 1897-98. By A. Brereton. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. xxvi., 218, and xlviii. *Map and Diagram. Price* 3*s*. 2*d*.

The total length of Indian railways open or sanctioned on March 31, 1898, was 25,454½ miles, of which over 21,150 miles were open for traffic.

India—Wrecks. **Falle.**

Return of Wrecks and Casualties in Indian Waters for the year 1897. Prepared by Commander P. J. Falle. Calcutta, 1898. Size 13 × 8½, pp. 62. *Map and Diagram. Presented by Commander P. J. Falle.*

Indian Ocean—Christmas Island. **Andrews.**
A Description of Christmas Island (Indian Ocean). By Chas. W. Andrews, B.SC. From the *Geographical Journal* for January, 1899. Size 10 × 6½, pp. 24. *Map and Illustrations.*

Indo-China. *B.S.G. Paris* **19** (1898): 261–290. **Bel.**
Mission au Laos et en Annam (Annam, pays Khas, Bas-Laos). Par J. M. Bel. *With Map and Illustrations.*

Indo-China. *Ann. G.* **8** (1899): 49–61. **d'Anty.**
Relation d'un voyage dans la région située au sud de Semao. Par M. P. Bons. d'Anty. *With Map and Illustrations.*

Journeys on the frontier region of China in the Mekong basin by the French Consul at Semao, in Yunnan.

Indo-China. *Questions Dipl. et Coloniales* **5** (1898): 449–457. **Lanessan.**
Les Chemins de fer de l'Indo-Chine et de la Birmanie. Par J. L. de Lanessan. *With Map.*

Indo-China. *Rev. Française* **24** (1899): 46–51. **Servigny.**
Indo-Chine: Les Chemins de fer projetés. Par J. Servigny. *With Map.*

Shows the existing Burmese lines, and the routes of projected railways from Burma and French Indo-China into Southern China.

Indo-China—Laos. *B.S.G. Lyon* **15** (1899): 327–332. **Massieu.**
Voyage au Haut-Laos. Par M^{me} Isabelle Massieu.

Malay Peninsula. *M.G. Ges. Wien* **41** (1898): 706–713. **Rowland.**
Bemerkungen über einen kleinen Stamm von Orang Bukit, zur Zeit angesiedelt und beobachtet auf Perhentian Tingi Estate, Negri Sembilan, Mai—September 1896. Von W. R. Rowland.

Particulars regarding a small clan of thirty individuals belonging to one of the tribes of Negri-Sembilan which numbers two hundred.

Russia—Siberia. *Contemporary Rev.* **75** (1899): 248-262. **Cobbold.**
A Trip to Lake Balkash. By R. P. Cobbold.

Russia—Siberia. *XXVI. Jahresb. Ver. Erdk. Dresden* (1898): 54–57. **Huth.**
Die Tungusen. Von Dr. Georg Huth.

Russia—Siberia. *Deutsche Rundschau G.* **21** (1898–99): 97–103, 171–175. **Studnicki.**
Das Klima Sibiriens. Von Ladislaus Studnicki.

This paper deals with the Siberian climate and its influence on vegetation.

Russian Central Asia. **Krahmer.**
Russland in Asien. Band. II. Russland in Mittel-Asien. Von Krahmer. Leipzig: Zuckschwerdt & Co., 1898. Size 9½ × 6½, pp. iv. and 182. *Illustrations. Price* 4*s.* 6*d.*

AFRICA.

Africa—Climate. ———
The Climatology of Africa—Seventh Report of a Committee of the British Association for the Advancement of Science (Bristol, 1898). Size 8½ × 6, pp. 8. *Presented by the Secretary of the Committee.*

Africa—Leo's Work. **Schefer.**
Recueil de Voyages et de Documents pour servir à l'Histoire de la Géographie depuis le XIII^e. jusqu'à la fin du XVI^e. siècle. [Vol. xv.] Description de l'Afrique tierce partie du Monde escrite par Jean Leon African. Premièrement en langue Arabesque, puis en Toscane et à présent mise en François. Nouvelle Édition annotée par Ch. Schefer. Troisième Volume. Paris: E. Leroux, 1898. Size 11 × 7½, pp. xiv. and 480. *Price* 21*s.*

Algeria. *Questions Dipl. et Colon.* **6** (1899): 193–205. **Bernard.**
La Situation politique de l'Algérie. Par M. Augustin Bernard.

Algeria—Coral. *Rev. Scientifique* **11** (1899): 74–78. **Layrle.**
La pêche du corail en Algérie. Par M. Layrle.

British Central Africa. ———
The Livingstonia Mission (British Central Africa), with Report for 1897–98. Size 9 × 5½, pp. iv. and 90. *Map.*

British and German East Africa. *Mouvement G.* **16** (1899): 115–116. ——

Entre les lacs Nyassa et Tanganika. Délimitation des sphères d'influence anglaise et allemande. *With Map.*

British South Africa. *J.S. Arts* **47** (1899): 209–224. **Wilkinson.**

Rhodesia and its Mines in 1898. By William Fischer Wilkinson. *With Maps and Sections.*

British South Africa. **Thomson.**

Rhodesia and its Government. By H. C. Thomson. London: Smith, Elder & Co., 1898. Size 8½ × 5½, pp. xii. and 352. *Map and Illustrations. Price* 10*s.* 6*d. Presented by the Publishers.*

A careful study of the actual conditions of the British South Africa Company's territories and of their administration. Most of the facts mentioned were observed by the author when in the country; the opinions were formed after consulting with a number of experienced people of all classes of the South African community. Suggestions are made as to the proper way of dealing with the natives.

British West Africa—Gold Coast. **Mischlich**

XXVI. Jahresb. Ver. Erdk. Dresden (1898): 33–98.

Verbot der nationalen Gebräuche in Krobo. Bericht des Herrn Missionars A Mischlich.

Some interesting particulars of the customs and beliefs of the Krobo people of the Gold Coast.

British West Africa—Gambia. *B.S.G. Lille* **30** (1898): 338–342. **Bonvalet.**

Notes sur la Gambie anglaise. Par E. Bonvalet.

These notes on the Gambia are the result of a personal visit.

British West Africa. *J. Anthrop. I.* **1** (1898): 95–103. **Shrubsall.**

Notes on Ashanti Skulls and Crania. By F. Shrubsall, B.A.

British West Africa—Niger. **Bindloss.**

In the Niger Country. By Harold Bindloss. London: W. Blackwood & Sons, 1898. Size 9 × 6, pp. x. and 338. *Maps. Price* 12*s.* 6*d. Presented by the Publishers.*

Mr. Bindloss gives a remarkably graphic account of the Niger Coast Protectorate, and of the other West African colonies excluding the Niger Company's domain. There is no attempt to exaggerate or to extenuate the conditions in which white men work upon the coast, and the various difficult questions which he considers are handled with calmness, discretion, and full knowledge.

British West Africa—Niger. *J. Anthrop. I.* **1** (1898): 104–126. **Granville and Roth.**

Notes on the Jekris, Sobos, and Ijos of the Warri District of the Niger Coast Protectorate. By Reginald K. Granville and Felix N. Roth. Prepared by H. Ling Roth. *With Plates.*

Cape Verd Islands. *B.S.G. Italiana* **12** (1899): 7–26. **Fea.**

Dalle Isole del Capo Verde. Lettera del . . . Leonardo Fea. *With Illustrations.*

Central Africa. **Bourdarie.**

Questions Dipl. et Colon. **5** (1898): 345–354, 419–427; **6** (1899): 21–30.

Les chemins de fer Congolais et de l'Afrique Centrale. Par M. Paul Bourdarie *With Maps.*

Central Africa—Angoniland. *Scottish G. Mag.* **15** (1899): 74–79. **Angus.**

A Trip to Northern Angoniland. By H. Crawford Angus.

Central Africa—Katanga. *Mouvement G.* **16** (1899): 121–124. ——

De Bruxelles au Katanga. *With Map.*

Congo. *Petermanns M.* **45** (1899): 19–21. **Singer.**

Das Kongo-Quellgebiet. Von H. Singer.

Congo State. *Mouvement G.* **16** (1899): 28–29. ——

La vingt et unième traversée de l'Afrique centrale.

The twenty-first crossing of Central Africa is that by Mr. Lloyd through the Pygmy country.

Congo State. **Boulger.**

The Congo State, or the Growth of Civilisation in Central Africa. By Demetrius C. Boulger. London: W. Thacker & Co., 1898. Size 9½ × 6, pp. viii. and 418. *Portrait, Map, and Illustrations. Price* 16*s.*

Congo State. *Fortnightly Rev.* **65** (1899): 433–444. **Boulger.**
The Congo State and its Critics. By Demetrius C. Boulger.

Congo State. *J.R. Statistical S.* **61** (1898): 640–667. **Courtney.**
An Experiment in Commercial Expansion. The Annual Address of the Right Hon. Leonard H. Courtney, M.A., M.P., President of the Royal Statistical Society. Session 1898–99.

A study of the economic condition of the Congo Free State.

Congo State. *Deutsche Rundschau G.* **21** (1899): 241–255. **Levy.**
Der Congostaat. Von Victor Levy. *With Illustrations.*

Congo State. *B.S. d'Études colon.* **5** (1898): 275–382. **Plas and Pourbaix.**
Le Régime économique et fiscal de l'État Indépendant du Congo. Par J. Plas et V. Pourbaix. (Deuxième partie.)

Congo State. *J. Anthrop. I.* **1** (1898): 35–47. **Burrows.**
On the Natives of the Upper Welle District of the Belgian Congo. By Captain Guy Burrows. *With Plate.*

Congo State. *B.S.R.G. d'Anvers* **22** (1898): 89–110. **Dubreucq.**
Les opérations Chaltin, dans le Haut-Uellé. Par le lieutenant R. Dubreucq.

On the military operations of the Congo State troops in the Wellé region.

Congo State. *Church Missionary Gleaner* (1899): 18–19. **Lloyd.**
Down the Congo from Uganda. By A. B. Lloyd. *With Map.*

Mr. Lloyd's interesting journey was referred to in the *Journal* for February, p. 195.

Congo State. **Wauters.**
A. J. Wauters. L'État Independant du Congo. Historique, Géographie physiqüe, Ethnographie, Situation économique, Organisation politique. Bruxelles: Falk, 1899. Size 7½ × 5, pp. xiv. and 528. *Map. Price 4s. 6d.*

Congo State. *Mouvement G.* **15** (1898): 586–589. **Wauters.**
Notre Carte de l'État Independant du Congo au 2,000,000^e. Feuille X.: La région des sources du Congo, le Katanga et le bassin du Bangweolo. *With Map.*

Congo State. **Wildeman, Durand, Boulenger.**
État Indépendant du Congo. Annales du Musée du Congo publiées par ordre du Secrétaire d'Etat. Série I. Botanique Illustrations de la Flore du Congo, par Em. de Wildeman et Th. Durand. Tome i. (Fasc. 1 and 2), (pp. 48).—Série II. Zoologie, Matériaux pour la Faune du Congo. Poissons nouveaux, par G. A. Boulenger. Tome i. (Fasc. 1 and 2), (pp. 38). Bruxelles: Librairie Falk Fils, 1898. Size 15 × 11½. *Plates. Presented by M. le Secrétaire de l'État Indépendant du Congo.*

Egypt. **Alban.**
Trade of Egypt for the year 1897. Foreign Office, Annual No. 2197, 1898. Size 9½ × 6½, pp. 24. *Price* 1½*d.*

Egypt. *P.R. Artillery I.* **26** (1899): 55–66. **Elmslie.**
Some Experiences in Egypt. By Major F. B. Elmslie, R.A. *With Illustrations.*

Description and photographs of the transport of troops up the Nile in the last Sudan expedition.

Egypt. *B.S. Khédiv. G.* **5** (1898): 123–128. **Fourtau.**
Note sur l'âge des forêts pétrifiées des déserts d'Égypte. Par M. R. Fourtau.

Egypt. ——
Egypt. No. 3 (1898). Further Correspondence respecting the Valley of the Upper Nile. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. 12. *Price 2d.*

Egypt—Early People. *Rev. Scientifique* **11** (1899): 289–296. **Zaborowski.**
Origines africaines de la civilisation de l'ancienne Égypte. Par M. Zaborowski.

Egyptian Sudan. *Scottish G. Mag.* **15** (1899): 57–74. ——
The Egyptian Sudan. *With Map.*

Egyptian Sudan. *P. R. Artillery I.* **26** (1899): 39–54. **Benson.**
A Patrol on the Atbara. By Major G. E. Benson. *With Map.*

Egyptian Sudan. **Gleichen.**
Handbook of the Sudan. Part I.—Geographical. The Sudan, South of Omdurman; from Wadai to Abyssinia, and from Khartum to the Albert Nyanza. Part II. —Historical Sketch of the History of the Sudan to date. Compiled in the Intelligence Division, War Office, by Captain Count Gleichen. 1898. London: Printed at the War Office, 1898. Size 7½ × 5, pp. xii. and 216. *Presented by the Compiler.*

A compact and systematic account of the eastern Sudan south of Khartum, with tables of distances along the Nile and its tributaries, and a summary of all existing information as to the resources of the country.

Egyptian Sudan. **Gleichen.**
Report on the Nile and Country between Dongola, Suakin, Kassala, and Omdurman. Describing the various routes bearing on this country. Compiled in the Intelligence Division, War Office, by Captain Count Gleichen. Second Edition. 1898. London: Printed at the War Office, 1898. Size 7½ × 5, pp. viii. and 338. *Maps. Presented by the Compiler.*

A description of the Nile between Dongola and Khartum, and of the Eastern desert, with routes and tables of distances.

Egyptian Sudan. *J. School G.* **3** (1899): 41–46. **Heawood.**
The Egyptian Sudan and its History. By Edward Heawood.

Egyptian Sudan. *Church Missionary Intelligencer* **50** (1899): 1–6. **Wilson.**
The Egyptian Soudan. By the Rev. C. T. Wilson. *With Map.*

Egyptian Sudan—Bahr-el-Ghazal. *Rev. Française* **24** (1899): 29–35. **Baratier.**
Dans les marais du Bahr-el-Ghazal. (Mission Marchand.) Lettre du capitaine Baratier.

French Congo. *B.S.G. Paris* **19** (1898): 308–327. **Foret.**
Le lac Fernan-Vaz (Congo français). Par M. Auguste Foret. *With Map.*

French Sudan. *A travers le Monde, Tour du Monde* **5** (1899): 5–6. **Combes.**
L'Aire géographique des Conquêtes de Samory. Par Paul Combes. *With Map.*

French West Africa. *B.S.G. Paris* **19** (1898): 328–374. **Pobéguin.**
Notes sur la Côte d'Ivoire. Région comprise depuis Grand-Lahou jusqu'au Cavally (République de Libéria). Par M. H. Pobéguin.

French West Africa. *Rev. Française* **24** (1899): 21–29. **Vasco.**
Poursuite et capture de Samory. Par G. Vasco. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* **11** (1898): 251–253. **Adams.**
Vom Nyassa-See nach Upogoro und Donde. Von P. Alfons M. Adams. *With Map.*

The paper is followed by a note by Dr. Richard Kiepert on the map.

German East Africa. *Petermanns M.* **45** (1899): 1–4. **Langhans.**
Pater Dromaux' Durchquerung von Deutsch-Ostafrika (Bagamojo—Kiwele—Karema). Mit Benutzung brieflicher Mittheilungen des Reisenden. Von Paul Langhans. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* **11** (1898): 255–283. **Prittwitz und Gaffron.**
Untersuchung der Schiffbarkeit des Kihansi und eines Theiles des Ulangaflusses. Von Hauptmann v. Prittwitz und Gaffron. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* **11** (1898): 240–246. **Schnauder and Cohn.**
Astronomische Ortsbestimmungen von W. Bornhardt. Angestellt 1896 im Nyassa-Gebiete. Von M. Schnauder.
Astronomische Beobachtungen von Bergassessor W. Bornhardt (Mai bis Oktober 1897). Von Dr. Fritz Cohn.

German East Africa. **Wohltmann.**
Deutsch-Ostafrika. Bericht über die Ergebnisse seiner Reise ausgeführt im Auftrage der Kolonial-Abteilung des Answärtigen Amtes, Winter 1897–98. Von Dr. F. Wohltmann. Schöneberg-Berlin: F. Telge, 1898. Size 9½ × 6½, pp. xii. and 92. *Map and Illustrations. Price* 4s. 6d.

German East Africa—Kilimanjaro. *Verh. Ges. Erdk. Berlin* **26** (1899): 88–101. **Meyer.**
Herr Dr. Hans Meyer: Ueber seine neue Kilima-Ndscharo-Expedition. *With Map.*

German East Africa—Kilimanjaro. *Die Natur.* **48** (1899): 27–29. **Reischel.**
Die Ergebnisse von Hans Meyer's Forschungsreise am Kilimandscharo. Von G. Reischel.

German East Africa—Uhehe. *M. Deutsch. Schutzgeb.* 11 (1898): 246–250. **Adams.**
Uhehe und das Land bis zum Nyassa-See. Von P. Alfons M. Adams. *With Map.*

German South-West Africa. *Globus* 75 (1899): 121–130. ——
Die wirtschaftliche Erschliessung Deutsch-Südwest-Afrikas. *With Illustrations.*

A notice of Dr. Rehbock's work on irrigation in German South-West Africa.

German West Africa—Kamerun. *Globus* 75 (1899): 1–4. **Hutter.**
Der Abschluss von Blutsfreundschaft und Verträgen bei den Negern des Graslandes in Nordkamerun. Von Hauptmann Hutter.

On blood-brotherhood as practised in the German protectorate.

German West Africa—Togo. *M. Deutsch Schutzgeb.* 11 (1898): 227–235. **Seefried.**
Beitrag zur Geologie des Schutzgebietes Togo. Von Lieutenant Frhrn. v. Seefried.

A description of rock-specimens collected in the north of Togo by Baron Seefried, and determined by Dr. v. Gümbel.

German West Africa—Togo. *M. Deutsch. Schutzgeb.* 11 (1898): 235–239. **Sprigade.**
Begleitworte zu der Karte des nördlichen Theiles des Schutzgebietes Togo und seiner Hinterländer. Von P. Sprigade. *With Map.*

These notes specify the sources of the information shown on the accompanying map, which is on the scale of 1 : 100,000, and takes in the area from 7° to 13° N., and from 1° 30′ W. to 3° 30′ E.

Gold Coast. *Tijds. Indische Taal-, Land- en Volkenk* 40 (1898): 385–496. **Doorman.**
Die Niederländisch West-Indische Compagnie an der Gold-Küste. Von J. G. Doorman. *With Map.*

This article describes the efforts of Usselinx early in the seventeenth century to promote Dutch colonization, and goes on to recount the proceedings of the Dutch West India Company, and the condition and history of the Gold Coast under Dutch control.

Gold Coast. *J.S. Arts* 47 (1899): 305–313. **Irvine.**
The Gold Mines of West Africa. By James Irvine.

Madagascar. *Antananarivo Annual* 6 (1898): 149–151. ——
The Fandroana or Annual Festival of the Taimoro; together with some other customs of that tribe.

The Taimoro tribe inhabit the south-eastern coast region of Madagascar. This description of the festival is translated from a native manuscript.

Madagascar. *Rev. Scientifique* 11 (1899): 261–269. **Gallieni.**
Mesures à prendre pour favoriser l'accroissement de la population en Emyrne. Par M. Gallieni.

Madagascar. *Antananarivo Annual* 6 (1898): 137–148. **Gautier.**
Western Madagascar: its Geology and Physical Geography. Translated from the French of Emile F. Gautier. By Rev. R. Baron.

Translated from the *Annales de Géographie* for April, 1895.

Madagascar. **Grandidier.**
Un Voyage de Découvertes sur les côtes Occidentale et Méridionale de l'Ile de Madagascar en 1613–1614. Relation par le P. Luiz Mariano, traduite et résumée par Alfred Grandidier. (Extrait du Bulletin du Comité de Madagascar.) Paris: A. Challamel, 1899. Size 10 × 6½, pp. 30.

Madagascar. *Antananarivo Annual* 6 (1898). **Sibree.**
Industrial Progress in Madagascar. By Rev. J. Sibree.

Recounts the advances made in Madagascar in various industrial arts, mainly as a result of the efforts of British missionaries.

Madagascar. *Ann. G.* 8 (1899): 74–82. **Zimmermann.**
La forêt à Madagascar. Par M. Maurice Zimmermann. *With Map and Profiles.*

On the distribution of forests in Madagascar.

Mauritius. *J. R. Colonial I.* 30 (1899): 113–118. **Anderson.**
The Sugar Industry of Mauritius. By James Forrester Anderson.

South Africa. *J. R. Colonial I.* 30 (1899): 77–113. **Hillier.**
The Native Races of South Africa. By Alfred P. Hillier, B.A., M.D.

West Africa. **Kingsley.**
West African Studies. By Mary H. Kingsley. London: Macmillan & Co., 1899. Size 9½ × 6, pp. xxiv. and 640. *Map and Illustrations. Price* 21*s.*

West Africa. **Trilles.**
Miss. Catholiques **30** (1898): 6, 18, 31, 41, 51, 68, 81, 92, 104, 116, 128, 136, 153, 166, 188, 199, 212, 226, 236, 261, 268, 285, 296, 310, 322, 329, 427, 435, 449, 464, 472, 490, 499, 508, 521, 534, 550.
Chez les Fang. Par le R. P. Trilles. *With Map and Illustrations.*

NORTH AMERICA.

Alaska. **Dunham.**
The Alaskan Goldfields and the opportunities they offer for Capital and Labor. By Sam. C. Dunham. (Bulletin of the Department of Labor. No. 19, November, 1898.) Washington, 1898. Size 9 × 6, pp. 789–828.

Bering Sea and Alaska. **Maclear.**
Sailing Directions for Bering Sea and Alaska, including the North-East Coast of Siberia. Compiled from various sources by Vice-Admiral J. P. Maclear. London: J. D. Potter, 1898. Size 9½ × 6, pp. xxvi. and 344. *Index Charts. Price* 4*s. Presented by the Hydrographer of the Admiralty.*

Canada. *Globus* **75** (1899): 85–89. **Bach.**
Der canadische Winter. Von Rudolph Bach. *With Illustrations.*

Canada. *J. R. Colonial I.* **30** (1899): 186–204. **Shaw.**
Klondike. By Miss Flora L. Shaw.

Canada. **Wrong and Langton.**
University of Toronto Studies. History, First Series, vols. 2 and 3. Review of Historical Publications relating to Canada for the year 1897. Edited by Prof. George M. Wrong, assisted by H. H. Langton (pp. x. and 238). Ditto for the year 1898. Edited by Prof. George M. Wrong and H. H. Langton (pp. x. and 226). [Toronto]: The University Library, 1898–99. Size 10½ × 7½. *Presented by the University of Toronto.*

A catalogue of current works on Canada, each title being followed by a short critical notice.

Canada—Geological Survey. ——
Geological Survey of Canada. Annual Report (New Series), Vol. IX. Reports A, F, I, L, M, R, S. 1896. Ottawa, 1898. Size 10 × 6½. *Maps and Illustrations. Presented by the Survey.*

This volume contains a summary report of the year's work by the Director; a report of over 200 pages by Mr. J. B. Tyrrell on the Doobaunt, Kazan, and Ferguson rivers, and the north-west coast of Hudson bay; a report by Dr. R. Bell on the geology of the French River sheet, Ontario; on the northern part of the peninsula of Labrador, by Mr. H. Low; on the geology of south-west Nova Scotia, by Mr. L. W. Bailey; and various mineralogical and statistical reports.

Canada—New Brunswick. ——
Saint John as a Canadian Winter Port, issued under the auspices of the City Corporation and Board of Trade. Saint John, New Brunswick, 1898. Size 10 × 7, pp. 22. *Map, Plans, and Illustrations. Presented by the Natural History Society of New Brunswick.*

Canada—Rocky Mountains. *Blackwood's Mag.* **165** (1899): 540–557. **Stutfield.**
Mountain exploration in the Canadian Rockies. By Hugh E. M. Stutfield.

On the search for Mount Hooker and Mount Brown, recently described by Prof. Collie to the Society.

Canada—Stikine River. *National G. Mag.* **10** (1899): 1–15. **Scidmore.**
The Stikine River in 1898. By Eliza Ruhamah Scidmore. *With Illustrations.*

Mexico—Vera Cruz. *B.S.G. y Estad. Rep. Mexicana* **4** (1898): 31–49. **Zárate.**
El Estado de Veracruz. Ensayo Geográfico y Estadistico del Sr. Lic. D. Julio Zárate.

Newfoundland. *A travers le Monde, Tour du Monde* **5** (1899): 37–38. ——
Les Droits de la France à Terre-Neuve. Le "French Shore." *With Map.*

Newfoundland. *Questions Dipl. et Colon.* **6** (1899): 140–152, 205–219. **Garreau.**
Les Intérêts français à Terre-Neuve. Par G. Garreau. *With Map.*

Niagara. **Martin.**

The Utilization of Niagara. By Thomas Commerford Martin.—Annual Report of the Smithsonian Institution, 1896, pp. 223–232. *Plates.* Washington, 1898.

Reprinted from the *Proceedings* of the Royal Institution.

United States. **Baedeker.**

The United States, with an Excursion into Mexico. Handbook for Travellers, edited by Karl Baedeker. *With* 19 *Maps and* 24 *Plans.* Second Revised Edition. Leipsic: K. Baedeker; London: Dulau & Co., 1899. Size 6½ × 4½, pp. c. and 580. *Price* 12*s.* *Presented by Messrs. Dulau & Co.*

United States. *J. School G.* **3** (1899): 1–5, 46–54. **Fenneman.**

Climate of the Great Plains. By N. M. Fenneman.

United States. **Inman and Cody.**

The Great Salt Lake Trail. By Colonel Henry Inman and Colonel William F. Cody. New York: the Macmillan Co.; London: Macmillan & Co., 1898. Size 9 × 6, pp. xii. and 530. *Map and Illustrations. Price* 14*s. net. Presented by the Publishers.*

This is a striking history of inland exploration and adventure, dealing as it does with the road across the Rocky mountains, past Salt Lake City, traversed by the Mormons, and later by the pony express and the overland stage before these were superseded by the telegraph and the railway. Colonel Cody ("Buffalo Bill") speaks from personal experience of the early days of the fight with an unusually adverse environment of desert, mountain, and hostile natives, and a considerable part of the volume deals with his adventures. The book appropriately concludes with the driving of the last spike of the first transcontinental railway.

United States. *Deutsche G. Blätter* **21** (1898): 175–312. **Oppel.**

Wirtschaftsgeographische Reise durch die Vereinigten Staaten. Von Dr. A. Oppel.

United States. **Rossi.**

Stati Uniti. L'Emigrazione Italiana agli Stati Uniti nell'anno 1897–98. Rapporto del cav. Egisto Rossi.—Bollettino del Ministero degli Affari Esteri. Dicembre, 1898. Roma, 1898. Size 9½ × 6½, pp. 30.

United States. *P.I. Civil Engineers* **134** (1898): 334–351. **Bartlett.**

The Transport of Coal on the Ohio and the Lower Mississippi. By J. H. Bartlett.

United States—Boundary. **Mendenhall.**

Twenty unsettled Miles in the North-east Boundary. By T. C. Mendenhall. Worcester, Mass., 1897. Size 10 × 6, pp. 26. *Map. Presented by the Author.*

On a part of the boundary between the United States and Canada in the north-east.

United States—California. *B.S.G. y Estad. Rep. Mexicana* **4** (1898): 131–145. **Jacobs.**

La Region Aurifera de la Alta California. Estudio presentado por el Sr. Henry S. Jacobs y traducido por el Sr. Ingeniero Enrique A. Turnbull.

Historical notes on the Californian goldfields.

United States—California. *Deutsche Rundschau G.* **21** (1898): 115–123. **Rabe.**

Das Erdbeben von Owens Valley in Californien. Von Johannes Karl Rabe. *With Illustrations.*

Recollections of the effects of the great earthquake of March 26, 1872.

United States—California. **Ransome.**

Some Lava Flows of the Western Slope of the Sierra Nevada, California. By F. Leslie Ransome.—Bulletin of the United States Geological Survey, No. 89. Washington, 1898. Size 9½ × 6, pp. 74. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Clouds. *National G. Mag.* 9 (1898): 493–496. **Johnson.**

Cloud Scenery of the High Plains. By Willard D. Johnson. *With Illustrations.*

A striking series of photographs showing the marvellous variety imparted to the absolutely monotonous scenery of the great American plains by the variety of cloud effects.

United States—Indian Territory. *National G. Mag.* **9** (1898): 481–490. **Fitch.**

The Five Civilized Tribes and the Survey of Indian Territory. By C. H. Fitch. *With Map and Illustrations.*

United States—Pennsylvania. *J. Franklin I.* **146** (1898): 416–423. **Lyman.**
Copper traces in Bucks and Montgomery Counties. By Benj. Smith Lyman. *With Map.*

United States—Tides. *National G. Mag.* **9** (1898): 497–509. **Jefferson.**
Atlantic Coast Tides. By Mark S. W. Jefferson. *With Diagrams.*

On the tides on the coast of New York and the New England States.

CENTRAL AND SOUTH AMERICA.

Argentina—Patagonia. *Deutsche Rundschau G.* **21** (1899): 206–219. **Greger.**
Patagonien und dessen Bewohner. Von J. Greger. *With Illustrations.*

Argentina—Patagonia. *Globus* **75** (1899): 101–104. **Hauthal.**
Erforschung der Glacialerscheinungen Südpatagoniens. Von Dr. R. Hauthal.

Argentine-Chile Boundary. **Steffen.**
Zur Erforschung des chilenisch-argentinischen Grenzgebiets in Patagonien. Von Dr. H. Steffen. (Abdruck aus Dr. A. Petermanns Mitteilungen, 1898, Heft 6.) Size 11 × 9½.

Argentine Republic. ———
Segundo Censo de la República Argentina Mayo 10 de 1895. Tomo ii. Población. Buenos Aires, 1898. Size 14 × 10½, pp. cxciv. and 710. *Maps and Diagrams. Presented by the Argentine Census Commission.*

This volume is devoted to the statistical, diagrammatic, and cartographic representation of the population of the Argentine Republic according to provinces and composition. The treatment of the statistics bearing on the foreign population of the country is particularly clear and graphic.

Bolivia. *B.S.G. La Paz* **1** (1898): 120–137, 137–161. **Marbán.**
Relación de la Provincia de la Virgen del Pilar de Mojos. Por el Padre Marbán, de la Compañia de Jesús.

Bolivia. *B.S.G. La Paz* **1** (1898): 92–119, 1–54. **Paredes.**
Monografía de la Provincia de Muñecas. Por M. Rigoberto Paredes.

Bolivia—Earthquakes. *B.S.G. La Paz* **1** (1898): 138–141, 162–167. **Saavedra.**
Caracteres seismicos de los Andes y del territorio boliviano. Por B. Saavedra.

Brazil. **Beaumont.**
Trade, Finances, and Colonisation of the Three Southern States of Brazil. Foreign Office, Miscellaneous, No. 493, 1899. Size 10 × 6, pp. 24. *Map. Price 4½d.*

Brazil—Minas Geraes. **Beaumont.**
A Journey to the Diamond Fields of Minas Geraes, and Remarks on the Province of Minas Geraes. Foreign Office, Miscellaneous, No. 494, 1899. Size 10 × 6½, pp. 30. *Price 2d.*

Central America. **Sapper.**
Ueber Gebirgsbau und Boden des nördlichen Mittelamerika. Von Dr. Carl Sapper.—Dr. A. Petermanns Mitteilungen, Ergänzungsheft Nr. 127. Gotha: Justus Perthes, 1899. Size 11 × 8, pp. vi. and 120. *Maps and Profiles.*

This piece of detailed work, by the indefatigable Dr. Carl Sapper, is accompanied by large maps of Northern Central America, as far east as the Gulf of Fonseca, on the scale of 1 : 1,100,000; one showing orographical features by tinted contours, the other geological. There are also a soil-map and a number of geological sections.

Tierra del Fuego. **Nordenskjöld.**
Från Eldslandet. Skildringar från den Svenska Expeditionen till Magellansländerna, 1895–97, samlade af Otto Nordenskjöld. Stockholm: P. A. Norstedt & Söner [not dated]. Size 10½ × 7, pp. 254. *Map and Illustrations.*

The narrative of Dr. Otto Nordenskjöld's exploration in the extreme south of South America. The map, which is orographically coloured, has its title and explanations in English.

West Indies—Mona. *Globus* **74** (1898): 368–372. **Hübener.**
Die Inseln Mona und Monito. Von Dr. Th. Hübener. *With Map and Illustrations.*

Description of the guano-yielding island of Mona, attached to Porto Rico.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Thomson.**

The Physical Geography of Australia. By J. P. Thomson.—Annual Report of the Smithsonian Institution, 1896. Pp. 245-272. Washington, 1898.

Reprinted from the *Proceedings* of the Brisbane branch of the Australasian Geographical Society.

Australia—Oceanography. **Fowler.**

Australasian Association for the Advancement of Science. Sydney Session, 1898. A Contribution to Australian Oceanography. By Thomas Walker Fowler. [Sydney, 1899.] Size 8½ × 5½, pp. 16. *Presented by the Author.*

British New Guinea. **Bevan.**

The Gold Rush to British New Guinea, 1887, and the Discovery of Aird and Purari Rivers. Also Supplement. By Theodore F. Bevan. (Extract from Transactions of the Royal Geographical Society of Australasia (Victoria), vol. xv.) Melbourne, 1898. Size 10 × 6½, pp. 8. *Map.*

British New Guinea. **Nelson.**

Report by the Right Honourable Sir H. M. Nelson on his Visit to British New Guinea. Brisbane, 1898. Size 13½ × 8½, pp. 32. *Presented by Dowager Lady Lamington.*

British New Guinea. **MacGregor.**

Annual Report on British New Guinea, from July 1, 1897, to June 30, 1898; with Appendices. Brisbane, 1898. Size 13½ × 8½, pp. xlvi. and 150. *Maps and Plates.*

A note on this report appears in the *Journal*, p. 540.

Ellice Islands—Funafuti. **David.**

Funafuti, or Three Months on a Coral Island: an Unscientific Account of a Scientific Expedition. By Mrs. Edgeworth David. London: John Murray, 1899. Size 8½ × 6, pp. xiv. and 318. *Portraits, Map, and Illustrations. Price* 12*s. Presented by the Publisher.*

A record of Prof. David's stay on Funafuti during the successful boring operations carried out with the purpose of testing the depth to which coral formations extend.

Hawaii. *J. Franklin I.* **147** (1899): 31-52. **Wiley.**

Agriculture in the Hawaiian Islands. By Dr. Harvey W. Wiley.

POLAR REGIONS.

Antarctic. *Verh. Ges. Erdk. Berlin* **26** (1899): 58-87. ——

Gemeinschaftliche Sitzung der Gesellschaft für Erdkunde zu Berlin und der Abteilung Berlin-Charlottenburg der Deutschen Kolonial-Gesellschaft am 16 Januar 1899. Tagesordnung: Die geplante Deutsche Südpolar-Expedition. Vortrag von Dr. v. Drygalski. Bemerkungen von Geh. Reg.-Rat v. Bezold. *With Map.*

The results of the meeting here described, were given in the *Journal* for April, p. 406.

Arctic Explorations. **Markham.**

Arctic Explorations. By Rear-Admiral A. H. Markham.—Annual Report of the Smithsonian Institution, 1896. Pp. 273-296. Washington, 1898.

Reprinted from the 'Report of the Sixth International Geographical Congress.'

MATHEMATICAL GEOGRAPHY.

Barometric altitudes. **Fowler.**

Australasian Association for the Advancement of Science. Sydney Session, 1898. The Determination of Heights by Barometric Methods, by Thomas Walker Fowler. [Sydney, 1899.] Size 8½ × 5½, pp. 8. *Presented by the Author.*

Describes experiments as to the determination of heights with the aneroid and boiling-point thermometer.

Geodesy. *B. Philosoph. S. Washington* **13** (1899): 251-268. **Preston.**

Recent Progress in Geodesy. By Erasmus Darwin Preston. *With Maps.*

Treats of the present position of our knowledge as to the size and figure of the Earth, and touches on the tetrahedral theory.

Hydrographical Surveying. **Wharton.**

Hydrographical Surveying. A description of the means and methods employed in constructing Marine Charts. By Rear-Admiral Sir William J. L. Wharton, K.C.B. Second and Revised Edition. London: John Murray, 1898. Size 9½ × 6, pp. viii. and 388. *Illustrations. Price 18s. Presented by the Publisher.*

The author states in his preface to the new edition of this well-known work that he has endeavoured to alter it as little as possible, confining the changes to necessary corrections and the description of new methods and instruments which have come into use since the first edition was prepared seventeen years ago. The most important modifications are in the methods of deep-sea soundings, on account of the revolution in the exclusive use of wire instead of hemp sounding-lines.

Latitude determination. *B.S.G. La Paz* 1 (1898): 125–136. **Idiaquez.**

Latitud Geográfica. Procedimiento preciso para su determinación. Por Eduardo Idiaquez.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Phenomena. **Cornu.**

Physical Phenomena of the Upper Regions of the Atmosphere. By Prof. Alfred Cornu.—Annual Report of the Smithsonian Institution, 1896. Pp. 125–133. *Plate.* Washington, 1898.

Translated from the original French memoir in the *Proceedings* of the Royal Institution.

Aurora. *Terrestrial Magnetism* 3 (1898): 5–12, 53–76, 149–178. **Abbe.**

The Altitude of the Aurora above the Earth's Surface. By Prof. Cleveland Abbe.

Climatology. **Manson.**

The Laws of Climatic Evolution. [By Marsden Manson, C.E., PH.D.] U.S. Department of Agriculture, Report for December, 1898. California Section of the Climate and Crop Service of the Weather Bureau. Size 12 × 9½, pp. 4–8.

Geological Deposits. **Van't Hoff, Williams, Meyerhoffer.**

Sitzb. A.W. Berlin (1898): 808–822.

Untersuchungen über die Bildungsverhältnisse der oceanischen Salzablagerungen, insbesondere des Stassfurter Salzlagers. X. Von J. H. van't Hoff und Percy Williams. XI. Von J. H. van't Hoff und Dr. W. Meyerhoffer.

Geomorphology. **Le Conte.**

Earth-Crust Movements and their Causes. By Joseph Le Conte.—Annual Report of the Smithsonian Institution, 1896. Pp. 233–244. Washington, 1898.

Reprint from *Science.*

Limnology. *Rev. Scientifique* 11 (1899): 140–142. **Forel.**

Les flaques d'eau libre dans la glace des lacs gelés. Par M. F.-A. Forel.

Limnology. *Die Natur* 47 (1898): 595–596, 604–606. **Ule.**

Zur Physik der Binnenseen. Von Willi Ule. III. Die Temperaturverhältnisse.

Marine Biology. **Murray.**

The General Conditions of Existence and Distribution of Marine Organisms. By Dr. John Murray.—Annual Report of the Smithsonian Institution, 1896. Pp. 397–409. Washington, 1898.

Reprinted from the 'Report of the Third International Congress of Zoologists.'

Meteorology. **Inwards.**

Meteorological Observations. By Richard Inwards.—Annual Report of the Smithsonian Institution, 1896. Pp. 149–166. Washington, 1898.

Reprinted from the *Journal* of the Royal Meteorological Society.

Meteorology. *Nineteenth Century* 45 (1899): 415–423. **Kropotkin.**

Weather Prediction. By Prince Kropotkin.

Oceanography. *P. Canadian I.* 1 (1898): 134–135. **Denison.**

The Origin of Ocean Tidal Secondary Undulations. By F. Napier Denison.

Oceanography. **Cronander.**

On the Laws of Movement of Sea-Currents and Rivers. By A. W. Cronander, PH.D. Norrköping, 1898. Size 12 × 10, pp. 58, 18, 22, 28, 6, 6, and 18. *Diagrams. Presented by the Author.*

Oceanography. *C. Rd.* **128** (1899): 212–214. **Monaco.**
Première compagne de la *Princesse-Alice* II^{e}. Note de S. A. S. le Prince Albert I^{er} de Monaco.

Notes on the cruise of the new *Princesse Alice*, a steamer of 1400 tons, to Spitsbergen in 1898.

Oceanography. *Nineteenth Century* **45** (1899): 295–303. **Pettersson.**
International Fishery Legislation. By Prof. Otto Pettersson.

Oceanography—Currents. *Ann. Hydrographie* **26** (1898): 519–521. ———
Unterströmungen in der Strasse von Bab-el-Mandeb.

A summary, with notes, of Commander Gedge's report on the work done by H.M.S. *Stork* in the strait of Bab el Mandeb.

Oceanography—North Atlantic. ———
Observations météorologiques-nautiques 1897 publiées par l'Institut Météorologique de Danemark. Kjøbenhavn, 1898. Size 12½ × 9½, pp. xviii. and 206. *Diagrams.*

The text is in parallel columns, French and Danish; the observations deal with ice-conditions in the East Greenland sea, air-temperatures at different hours at the Danish lightships, and on the temperature of the surface water in the North Atlantic and Davis strait in 1897.

Oceanography—Pacific. *Petermanns M.* **45** (1899): 4–8. **Lindenkohl.**
Physiographische Probleme, Salzgehalt und Temperatur des Pacifischen Ozeans betreffend. Von A. Lindenkohl. *With Diagrams.*

Oceanography—South Atlantic. *Ann. Hydrographie* **27** (1899): 37–39. **Dinklage.**
Unerforschte Bank im Südatlantischen Ozean. Von L. E. Dinklage.

This note calls attention to the fact that in 1854 a vessel bound from Callao to Mauritius found shallow soundings (80 to less than 25 fathoms) along a stretch of ocean midway between Cape Horn and the Cape of Good Hope. Other vessels also at various dates have reported signs of shallow water, but the facts are not recorded on the charts, and have been almost forgotten.

Photogeography. *Naturw. Wochenschrift* **13** (1898): 601–608. **Detmer.**
Zur Charakteristik einiger Vegetationsformationen. Von Prof. Dr. W. Detmer.

On the general characteristics of vegetation in the different classes of woodland.

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 41–46. **Agamennone.**
Sopra un nuovo tipo di sismoscopio. Nata di G. Agamennone. *With Illustration.*

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 46–48. **Cancani.**
Nuovo sismometrografo a registrazione veloce-continua. Nota del dott. Adolfo Cancani.

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 76–79. **Cancani**
Periodicità dei terremoti adriatico-marchigiani e loro velocità di propagazione a piccole distanze. Nota del dott. Adolfo Cancani.

Terrestrial Magnetism. *Meteorolog. Z.* **15** (1898): 449–462. **Schwalbe.**
Mittheilungen über die jährliche Periode der erdmagnetischen Kraft. Von G. Schwalbe.

Zoogeography. *Blackwood's Mag.* **165** (1899): 89–92. **Sharpe.**
The Preservation of African Elephants. By Alfred Sharpe.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Ratzel.**
The History of Mankind. By Prof. Friedrich Ratzel. Translated from the Second German Edition. By A. J. Butler, M.A. With Introduction by E. B. Tylor, D.C.L., F.R.S. 3 vols. London: Macmillan & Co., 1896–98. Size 10 × 7, pp. (vol. i.) xxiv. and 486; (vol. ii.) xiv. and 562; (vol. iii.) xiv. and 600. *Maps, Coloured Plates, and Illustrations. Presented by the Publishers.*

This work has been published in parts, and is now completed in three handsomely illustrated volumes. It is gratifying to find so important a scientific work well translated, and put before the British public in a form so attractive that it will interest even the unscientific.

Commercial Geography—Cables. *Rev. Française* 24 (1899): 215–220. **Salaignac.**
Les communications télégraphiques sous-marines, au point de vue stratégique. Par A. Salaignac. *With Map.*

Commercial Geography—Canals. *J.S. Arts* 47 (1899): 153–172. **Vernon-Harcourt.**
Inland Navigation in Europe and North America, with special reference to Inland Navigation in England. By Leveson Francis Vernon-Harcourt.

Historical. *B.S.G. Paris* 19 (1898): 375–387. **Corbeiller.**
La question Jean Cousin. Par Édouard le Corbeiller.

A discussion of the claims of the Dieppe navigator, Jean Cousin, to have discovered the mouth of the Amazon and the southern point of Africa in 1489.

Historical—Fernando Columbus. **Castillo y Quartiellerz.**
B.S.G. Madrid 40 (1898): 193–201.
Documento inédito del siglo xvi. referente á D. Fernando Colón. Conferencia dada el dia 24 de Mayo de 1898 por el Excmo. Sr. D. Rodolfo del Castillo y Quartiellerz.

Historical—Maps. **Magnaghi.**
La Carta Nautica Costruita nel 1325 da Angelino Dalorto. Notizia di Alberto Magnaghi. (Ai cultori degli studi geografici per ricordo del Terzo Congresso Geografico Italiano e delle secolari onoranze a Paolo Toscanelli e ad Amerigo Vespucci offre Tommaso Corsini.) Firenze, 1898. Size 14 × 10, pp. 16. *Map. Presented by Principe Tommaso Corsini.*

Historical—The Levant. ——
LXII. Neujahrsblatt zum Besten des Waisenhauses in Zürich für 1899. Ein Jerusalem- und Sinaipilger aus Zürich im 15 Jahrhundert: der Predigermönch Felix Schmid. Zürich, 1899. Size 11 × 9, pp. 62. *Illustrations. Presented by the Secretary of the Stadtbibliothek, Zürich.*

An account of the journeys of the monk Felix Schmid to Jerusalem in 1480 and subsequent years.

Historical—Vasco da Gama. ——
Quatrième Centenaire de Vasco da Gama à la Société de Géographie de Lisbonne. Extrait du 'Bulletin de la Société royale belge de Géographie,' 1898. Bruxelles, 1898. Size 9 × 6½, pp. 8.

BIOGRAPHY.

Campbell. **Bryce.**
Sketch of the Life and Discoveries of Robert Campbell, Chief Factor of the Hon. Hudson's Bay Company. By George Bryce, LL.D. The Historical and Scientific Society of Manitoba. Transaction No. 52. Winnipeg, 1898. Size 9 × 6, pp. 18. *Portrait and Illustrations. Presented by the Society.*

Robert Campbell (1808–1894) was the discoverer of the Upper Yukon, and gave the names of most of the rivers and mountains in that region which now appear on the map.

Giraud. *Deutsche Rundschau G.* 21 (1899): 231–232. ——
Victor Giraud. *With Portrait.*

Honterus. *Deutsche Rundschau G.* 21 (1899): 228–230. ——
Johannes Honterus. *With Illustration.*

Prestwich. **Woodward.**
Joseph Prestwich. By H. B. Woodward. Annual Report of the Smithsonian Institution, 1896. Pp. 657–666. Washington, 1898.
Reprinted from *Natural Science.*

Proskowetz. *Deutsche Rundschau G.* 21 (1899): 278–280. ——
Dr. Max v. Proskowetz. *With Portrait.*

Ross. *Deutsche Rundschau G.* 21 (1899): 276–278. ——
Sir James Clark Ross. *With Portrait.*

Selwyn. *Geolog. Mag.* 6 (1899): 49–55. ——
Eminent Living Geologists: Alfred Richard Cecil Selwyn, C.M.G., etc. *With Portrait.*

GENERAL.

Abyssinian Literature. **Budge.**
Lady Meux Manuscript No. 1. The Lives of Mabâ' Sĕyôn and Gabra Krĕstôs. The Ethiopic Texts edited with an English Translation and a Chapter on the Illustrations of Ethiopic Manuscripts. By E. A. Wallis Budge, M.A., etc. With Ninety-two Coloured Plates and Thirty-three Illustrations. London: W. Griggs, 1898. Size 12½ × 10½, pp. lxxxiv., 144, and 66. *Presented by Lady Meux.*

This superb volume contains a series of brilliant reproductions of Ethiopian pictures of the early part of the seventeenth century, together with the English translation and Ethiopian text of the lives of the saints whose doings are represented.

Amber in Early Trade. **Schweiger-Lerchenfeld.**
Oesterr. Monats. Orient **24** (1898): 138–142.
Der Bernstein als Handelsartikel der Alten. Von A. v. Schweiger-Lerchenfeld.

Army Medical Report. ——
Army Medical Department. Report for the year 1897. With Appendix. Volume xxxix. London: Eyre and Spottiswoode, 1898. Size 9½ × 6½, pp. x. and 602. *Diagrams. Price* 2*s.* 11*d. Presented by the War Office.*

Ballooning. *J.S. Arts* **47** (1899): 277–284. **Bacon.**
The Balloon as an Instrument of Scientific Research. By Rev. John M. Bacon. *With Diagrams.*

Ballooning. *Rev. Scientifique* **11** (1899): 138–140. **Hervé.**
Les ballons à déviateurs. Par M. Henri Hervé. *With Map.*

Bibliography—English Catalogue. ——
The English Catalogue of Books for 1898. London: Low & Co., 1899. Size 10 × 6½, pp. 256. *Price* 5*s.*

British Empire. **Sanderson.**
The British Empire in the Nineteenth Century: its Progress and Expansion at Home and Abroad, comprising a description and history of the British Colonies and Dependencies. By Edgar Sanderson, M.A. 6 vols. London, etc.: Blackie & Son, 1898. Size 10½ × 7, pp. (vol. i.) viii. and 336; (vol. ii.) viii. and 344; (vol. iii.) viii. and 344; (vol. iv.) viii. and 344; (vol. v.) viii. and 362; (vol. vi.) viii. and 370. *Maps and Illustrations. Presented by the Publishers.*

"The purpose of this work is to depict the progress and condition of the British Empire in the nineteenth century, and to furnish a complete historical and descriptive account of our Colonial Possessions and Dependencies in every quarter of the globe, from the time of British occupation, or, in some cases, from an earlier period, till the present day." Besides the general histories, chapters are devoted to the progress in various branches of science, art, literature, and public life during the century; amongst others, exploration and travel receive brief notice, but the development of scientific geography is not referred to. So rapidly does the Empire progress, that the maps in this work are in some cases already out of date, *e.g.* in the Niger boundaries, and the great mining centres and railways of Canada. An interesting set of pictorial statistics, comparing 1801 and 1897, concludes the book.

Coins. **Macdonald.**
Catalogue of Greek Coins in the Hunterian Collection, University of Glasgow. Volume I. Italy, Sicily, Macedon, Thrace, and Thessaly. By George Macdonald, M.A. Glasgow: James Maclehose & Sons, 1899. Size 12 × 9½, pp. lxvi. and 496. *Plates. Presented by the Hunterian Museum.*

Oriental Literature. **Das.**
Legends and Miracles of Buddha, Sakya Sinha. Part i. Translated from the Avadan Kalpalata of Bodhi-Sattwas, of the great Sanskrit Poet Kshemendra. By Nobin Chandra Das, M.A. Calcutta: Jadu Nath Seal, 1895. Size 8½ × 5½, pp. xvi. and 60. *Presented by the Author.*

Travel round the World. **[Chaudoir.]**
Ballade autour du Monde, par un Ancien de la Cambre. Bruxelles: Société Belge de Librairie, 1899. Size 10 × 6½, pp. 300. *Maps and Illustrations. Presented by the Publishers.*

The author of this prettily illustrated record of a somewhat unusual trip round the world is stated in an accompanying circular to be M. Puck Chaudoir. The selection and reproduction of the illustrations are particularly good. The route led through

Egypt, Ceylon, Tuticorin, Madras, Poona, Delhi, Calcutta, Manipur, through the Shan country to Mandalay, from Moulmein to Bangkok overland, thence by sea touching at Singapore, Saigon, Hongkong, Japan, and back to Europe through Canada.

Treaties.

Miscellaneous, No. 2 (1898). Treaties containing Guarantees or Engagements by Great Britain in regard to the Territory or Government of other Countries. London: Eyre & Spottiswoode, 1898. Size 13¼ × 8½. pp. vi. and 136. *Price* 1*s.* 2*d.*

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Germany. **Gradmann.**

Der obergermanisch-rätische Limes und das fränkische Nadelholzgebiet von Dr. R. Gradmann. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 6. Gotha : Justus Perthes, 1899. *Presented by the Publisher.*

Germany. **Langhans.**

Deutsche und Dänen in Nordschleswig. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Paul Langhans. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 4. Gotha : Justus Perthes, 1899. *Presented by the Publisher.*

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1898. Sheets: 297, Zielenzig; 321, Krossen a.d. Oder; 330, Münster; 405, Lüdenscheid; 406, Attendorn; 431, Waldbröl. Scale 1 : 100,000 or 1·6 stat. mile to an inch. *Price* 1.50 *marks each sheet.*

ASIA.

Central Asia. **Grenard.**

J.-L. Dutreuil de Rhins. Mission Scientifique dans la Haute Asie. Atlas des Cartes par F. Grenard. Ouvrage publiè sous les auspices du Ministère de l'Instruction Publique et des Beaux-Arts. Paris: Ernest Leroux, 1898. *Presented by the Author.*

This atlas contains twenty-five maps, giving the results of the route-surveys of MM. J. L. Dutreuil de Rhins and F. Grenard, made during their journeys through Central Asia from Khotan to Sining. The maps have been produced under the auspices of the Ministry of Public Instruction, Paris, and drawn by M. J. Hansen, under the direction of Mr. F. Grenard. Those of Eastern Turkistan are on the scale of 1 : 300,000; those of the journey through Tibet, on the scale of 1 : 500,000. Positions have been fixed by the astronomical observations of M. Dutreuil de Rhins, altitudes are given along the routes followed, notes describing the character of the country traversed are given, and the hill work shown by contours. A glance at this series of maps will show the large amount of careful survey work which these explorers accomplished under very difficult circumstances.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 111, parts of districts Muzaffarpur, Darbhanga, Bhagalpur, and Purnea (Bengal), and of Nepal; 118, district Jalpáiguri and Kuch Behar (Native State), and parts of districts Darjiling, Goálpára, Rangpur, Sikkim, and Bhutan (Native States). Quarter-sheets: 1, parts of districts Karachi, Shikarpur, and Hyderabad, and Native State of Khairpur (Sind, Bombay Presidency); 9 N.W., parts of districts Shikarpur and Hyderabad, and of Khairpur Native State (Sind, Bombay Presidency); 37 S.W., parts of districts Surat, Khándesh, and Nasik, Rewa Khantha, Surat and Khandesh Agencies, and Native State of Baroda (Bombay Presidency); 61 N.E., parts of districts Salem, Coimbatoire, and Nilgiri (Madras Presidency), and of the Native State Mysore; 67 S.W., parts of districts Bareilli, Budaun, Aligarh, etc., and of Rámpur Native State (N.W. Provinces); 95 N.W., part of district Kistna (Madras Presidency); 124 N.E., part of districts Nowgong and Darrang of Assam and Bhutan; 124 S.E., parts of districts Kamrup, Nowgong, Darrang, Cachar, Khasi, and Jaintia and Naga Hills (Assam); 127 N.W., parts of districts Backergunge and Noakhali (Bengal).—Skeleton map of the Punjab and surrounding countries, 1 inch to 32 miles. Additions to September, 1898.—Sind Survey, 1 inch to a mile. No. 66, districts Hyderabad and Thar and Porkar, Season 1896–97, Preliminary Issue.—Central India and Rajputana Survey, 1 inch to a mile. No. 213, parts of Gwalior, Jhabna, Bori, Rajpur Ali, Jobat, and Indore (Central India Agency), Season 1879–80.—Bengal Survey, 1 inch to a mile. Parts of districts Lohardaga and Singhbhum (Bengal), Season 1863–65.—Lower Burma Survey, 1 inch to a mile. No. 282, district Hanthawadi, Season 1881–82.—District Mymensingh, Bengal, 1 inch to 8 miles. Corrections to 1898.—District Raipur, Central Provinces, 1 inch to 20 miles, 1898.—District Narsinghpur, Central Provinces, 1 inch to 8 miles, 1898.—District Bálaghát, Central Provinces, 1 inch to 12 miles, 1898.—District Hoshangabad, Central Provinces, 1 inch to 12 miles, 1898.—District Nágpur, Central Provinces, 1 inch to 8 miles, 1898.—District Bogra, Lower Provinces, Bengal, 1 inch to 4 miles, 1897.—District Simla, with adjoining Native States, 1 inch to 4 miles, 1898.—Bombay Topographical Survey. Triangulation Charts for sheets 209 and 210, Season 1892–93; 243, 244, 275, and 276, Seasons 1884–90 (2 charts on

1 sheet), 1898. Charts of Triangulation, 1 inch to 2 miles. Sheets: Nos. 1, 5. 6, 7, Seasons 1891–94.—Calcutta and surrounding country, 1 inch to a mile, 1898. 3rd edition, 3 sheets and pamphlet. Index to the Standard Sheets of Bengal, 1898.—Map of Persia in 6 sheets, 1 inch to 16 miles, 1898. *Presented by H.M. Secretary of State for India through the India Office.*

Philippine Islands. **U.S. War Department.**

Province of Cavite. Scale 1 : 135,000 or 2·1 stat. miles to an inch. War Department, Adjutant-General's Office, Military Information Division. Washington, D.C., 1898.

Shantung. **Gaedertz.**

Wegeaufnahmen in der Provinz Schan-Tung, als Vorarbeit für die geplante Eisenbahn von Tsing-Tau über Tsinan-Fu nach Té-Tschou ausgeführt und gezeichnet von Ober-Ingenieur A. Gaedertz, 1898. Scale 1 : 500,000 or 7·9 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 5. Gotha: Justus Perthes, 1899. *Presented by the Publisher.*

AFRICA.

Africa. **Service Géographique de l'Armée, Paris.**

Carte de l'Afrique. Scale 1 : 2,000,000 or 31·1 stat. miles to an inch. Sheet 14, Assouan. Service Géographique de l'Armée, Paris. *Price* 1 *fr.*

Africa. **Prompt.**

Carte de la Vallée du Nil du Lac Tchad et du Bassin du Congo. Scale 1 : 6,000,000 or 94·7 stat. miles to an inch. Dressée par M. Prompt, Inspecteur général des Ponts-et-Chaussées en retraite. Maison Andriveau-Goujon (Henry Barrère), Paris. 1898. *Presented by the Publisher.*

This is a roughly produced map containing several serious errors in the manner in which the boundaries are laid down.

AMERICA.

Central America. **Sapper.**

1. Originalkarte des nördlichen Mittelamerika. Nach eigenen Aufnahmen und allen vorhandenen Quellen entworfen und gezeichnet von Dr. Carl Sapper. Scale 1 : 1,100,000 or 17·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 127, Tafel i.
2. Geologische Karte des nördlichen Mittelamerika von Dr. Carl Sapper. Scale 1 : 1,100,000 or 17·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 127, Tafel ii.
3. Skizze einer Bodenkarte des nördlichen Mittelamerika von Dr. Carl Sapper, 1897. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 127, Tafel iii.
4. Geologische Profile durch Yucatan, Chiapas, Tabasco, Guatemala, etc. Entworfen und gezeichnet von Dr. Carl Sapper. *Petermanns Geographische Meitteilungen*, Ergänzungsheft No. 127, Taf. iv. und v. Gotha: Justus Perthes, 1899. *Presented by the Publisher.*

Cuba. **U.S. War Department.**

Military Map of the Island of Cuba. Prepared in the War Department, Adjutant-General's Office, Military Information Division. Washington, D.C., 1898. Scale 1 : 250,000 or 3·9 stat. miles to an inch. 8 sheets.

Havana Province, Cuba. Scale 1 : 105,600 or 1·6 stat. mile to an inch. Adjutant-General's Office, Military Information Division. Washington, D.C., 1898.

These maps have been prepared for the use of the United States officers in the late Cuba campaign. They have been compiled from the latest official sources, giving the boundaries of provinces, judicial districts, and municipalities. The importance of towns is indicated by the symbols employed to mark their position; railways, roads, and paths are laid down, and all telegraph stations are shown.

Haiti. **Tippenhauer.**

Geologische Karte eines Teiles von Südwest-Haiti. Scale 1 : 200,000 or 3·2 stat. miles to an inch. Von L. Gentil Tippenhauer, 1898. *Petermanns Geographische Mitteilungen.* Jahrgang 1899, Tafel 3. Gotha: Justus Perthes, 1899. *Presented by the Publisher.*

AUSTRALIA.

Western Australia. **Maitland.**

Geological Map of the Collie Coal Field, Scale 1 : 31,680 or 0·5 stat. mile to an inch. A. Gibb Maitland, Government Geologist, 1898. Geological Survey of Western Australia. *Presented by the Author.*

GENERAL.

World. **Meyer.**

Meyer's Hand-Atlas. Zweite, neubearbeitete und vermehrte Auflage mit 112 Kartenblättern, 9 Textbeilagen und Register aller auf den Karten verzeichneten Namen. I. Lieferung. Leipzig und Wien. Verlag des Bibliographischen Instituts, 1899. *Price* 30 *pf.*

This is the first part of the second edition of Meyer's Hand-Atlas, which, when complete, will contain 112 principal maps, and a full index of all the names which appear. It is designed for handy reference, and a special feature will be the plans of the principal cities of the world, which will be produced on a comparatively large scale. Twelve new maps will be added, and the others will be corrected and brought up to date. It is to be completed in thirty-eight parts, and the total price will be 11*s*. 6*d*.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty**

Charts and Plans published by the Hydrographic Department, Admiralty, January and February, 1899. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3013 m	= 1·4	Norway :—The Naze to Songvaar fiord, including the approaches to Svinör and Mandal. 2*s*. 6*d*.
3011 m	= 1·4	Norway, south-west coast :—Lister to Haadyret. 2*s*. 6*d*.
3035 m	= 0·28	Plans in Novaya Zemlya :—Matochkin strait. 1*s*. 6*d*.
2332 m	= 1·9	Peru :—Ferrol and Coisco bays. 2*s*.
3029 m	= 0·95	Strait of Georgia :—Active pass to Gabriola pass and inner channels, Chemainus bay. 1*s*. 6*d*.
3022 m	= 3·6	Alaska :—Wrangell strait. 2*s*. 6*d*.
1012 d	= 1·55	Arabian sea. 2*s*. 6*d*.
3031 m	= var.	Bays and anchorages on the east coast of Borneo :—Buja and Manimbora anchorages, Sangkulirang bay, Balik Papan bay, anchorage near the east point of Balik Papan bay, Kelumpang bay. 1*s*. 6*d*.
2618 m	= 4·91	Formosa, north coast :—Kelung harbour. 1*s*. 6*d*.
2350 m	= 0·5	Australia, east coast :—Double point to Cape Grafton. Plan, Cairns harbour. 2*s*. 6*d*.
2117		Keil bay :—Plan added, Als sound.
2366		Germany, north coast. Arkona to Dievenow river :—Plan added Sassnitz harbour.
2146		France, north coast :—Plan added, Villers to Le Havre, including the entrance to the Seine.
1869		Canary islands, Gran Canaria :—Plan added, Maspalomas anchorage.
919		Anchorages in the gulf of Aden :—Plan added, Bulhar anchorage.
1348		Natuna islands :—Plan added, Salat Lampa.
2718		Anchorages on the east coast of the Celebes :—Plan added, Kiertong road, Limba bay, Dolupi road.
1342		Cochin China :—Plan added, entrance to the Tourane river.
134		New Hebrides :—Plan added, Anuda or Cherry island.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
2260	Plans of Manne fiord, and entrances to Svinör on this sheet.	New chart. The Naze to Songvaar fiord	3012
2333	Plan of Port Ekaterininskoi or Catherine on this chart.		
2680	Entrance of the Seine.	Plan added. Villers to Le Havre on this sheet . .	2146

No.	Cancelled by	No
1285 Plan of Ferrol bay on this chart. 1294 Plan of bay of Santa on this sheet.	New plan. Ferrol and Coisco bays	2332
1012 Gulf of Aden.	New chart. Arabian sea	1012
253B Jebel Jan to Seyára eastern sheet.		
2618 Kelung harbour.	New plan. Kelung harbour	2618
2350 Double point to Cape Tribulation.	New chart. Double point to Cape Grafton	2350

Charts that have received Important Corrections.

A-P. Index charts. 1188, The World:—Coal and telegraph chart. 1698, England, south coast:—Dover bay. 34, the Scilly isles. 1406, North sea:—Dover and Calais to Orfordness and Scheveningen. 2333, Lapland:—Varanger fiord to Oleni Nyemetski island. 2138, Baltic:—Approaches to the Gron sound. 213, Baltic:—Entrance to Gron sound. 2205, Black sea:—Kertch strait. 2058, North Atlantic:—Route chart. 1354A, Falkland islands. 278, North Polar chart, Pacific side. 797, River St. Lawrence:—Quebec to Kingston. 2860, United States, east coast:—Savannah river to St. Helena sound. 483A, West Indies:—Trinidad island and gulf of Paria. 481, West Indies:—Serpents mouth. 1285, Peru:—Begueta bay to river Chicama. 1357, Africa, west coast:—River Benin to river Cameroon. 1361, Africa, west coast:—Fernando Po to Cape Lopez. 653, Africa, east coast:—Ports of Conducia, Mozambique, and Mokambo. 66A, Maldive islands. 66B, Maldive islands. 941B, Eastern Archipelago, western portion. 2195, Anchorages in the eastern part of Celebes. 2577, Philippine islands:—Between St. Bernardino and Mindoro straits. 1269, Cochin China:—Saigon or Don-nai river. 1602, China:—Approaches to the Yang-tse kiang. 1316, Korea:—Cape Duroch to Linden point. 475, north-west coast of Australia. 1700, Australia, west coast:—Gage roads. 363, Australia, east coast:—Keppel bay and islands. 2532, New Zealand:—Ninety miles beach to Otago. X. 11, Signs and abbreviations adopted in Admiralty charts.

(*J. D. Potter, Agent.*)

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for March and April, 1899, and North Pacific Ocean for April, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Rocky Mountains. **Wilcox.**

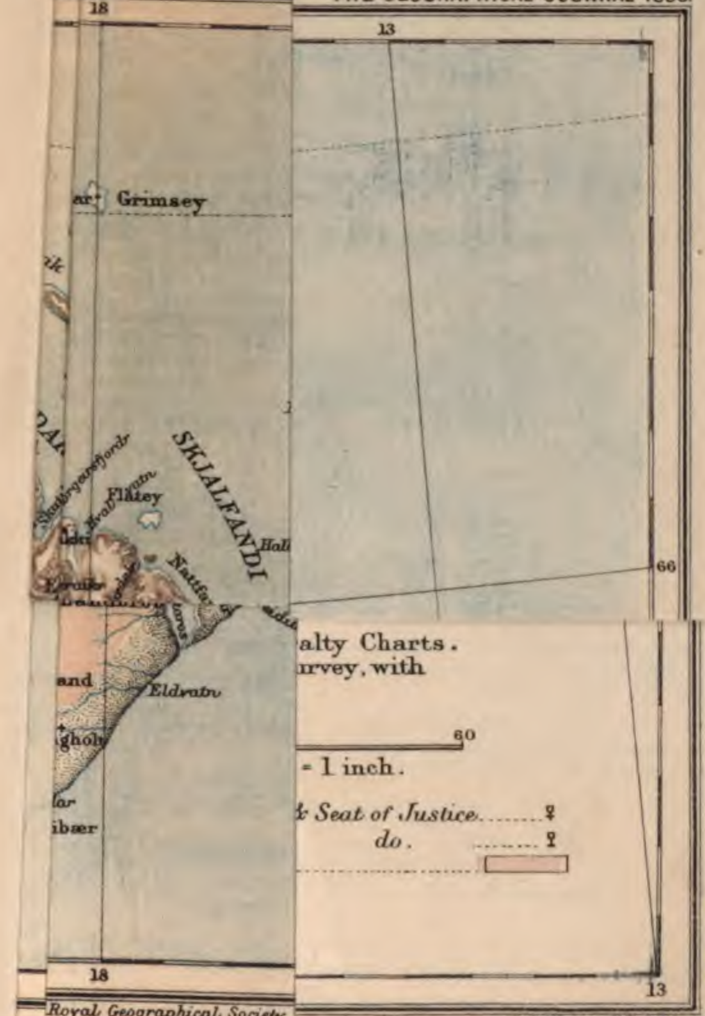
Six Photographs of the Upper Saskatchewan River Region, Canadian Rocky mountains, by W. D. Wilcox, Esq. *Presented by W. D. Wilcox, Esq.*

This series of photographs, of which the following is a list, consists of views taken on the eastern slopes of the Canadian Rocky mountains:—

(1) Source of the Little Fork of the Saskatchewan; (2) Swamp in Little Fish valley; (3) Camp scene in cañon of North Fork; (4) Fall near source of North Fork; (5) Mount Forbes from about 9000 feet; (6) Winter scene in pass between Blaeberry and Kicking Horse river.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

THE GEOGRAPHICAL JOURNAL 1899.



Royal Geographical Society.

F. S. Weller, F.R.G.S. lith.

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The
Geographical Journal.

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THE NYASA-TANGANYIKA PLATEAU.*

I.

By Captain F. F. R. BOILEAU, R.E.

When, last year, I was in Africa as a member of the Anglo-German Boundary Commission, the British section of which was under the command of Captain C. F. Close, R.E., I crossed the Nyasa-Tanganyika plateau; and to-night, in compliance with an invitation I have had the honour of receiving from the Council of your Society, I shall place before you some facts about this tract of country and the people, and I shall also give an account of the methods employed in the surveying work of the Commission. But it is desirable, before describing the plateau, to give a brief description of the route followed to reach the plateau. Chinde, the port at one of the mouths of the Zambezi river, is twenty-eight days distant from England *viâ* the Suez canal to Quilimane in a German steamer and on to Chinde in a coasting vessel, or thirty-three days *viâ* Cape Town and Durban, and thence on in a coasting vessel. Starting from Chinde there is first an eight days' passage up the Zambezi and Shire rivers in flat-bottomed stern-wheelers to Katunga's; thence, leaving the river, two days' journey in a machilla (or hammock slung on a pole) along a good road through Blantyre to the river again at Matope, whence Fort Johnston is reached after twenty-four hours' passage in a small stern-wheel steamer. Here a trans-shipment into one of the seven steamers plying on Lake Nyasa is necessary, and, provided that rough weather is not encountered, the traveller should arrive in five days at Karonga, the British station at the head of the lake. This gives about forty-nine days in all for the journey from

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* Two papers read at the Royal Geographical Society, April 24, 1899. Map, p. 692.

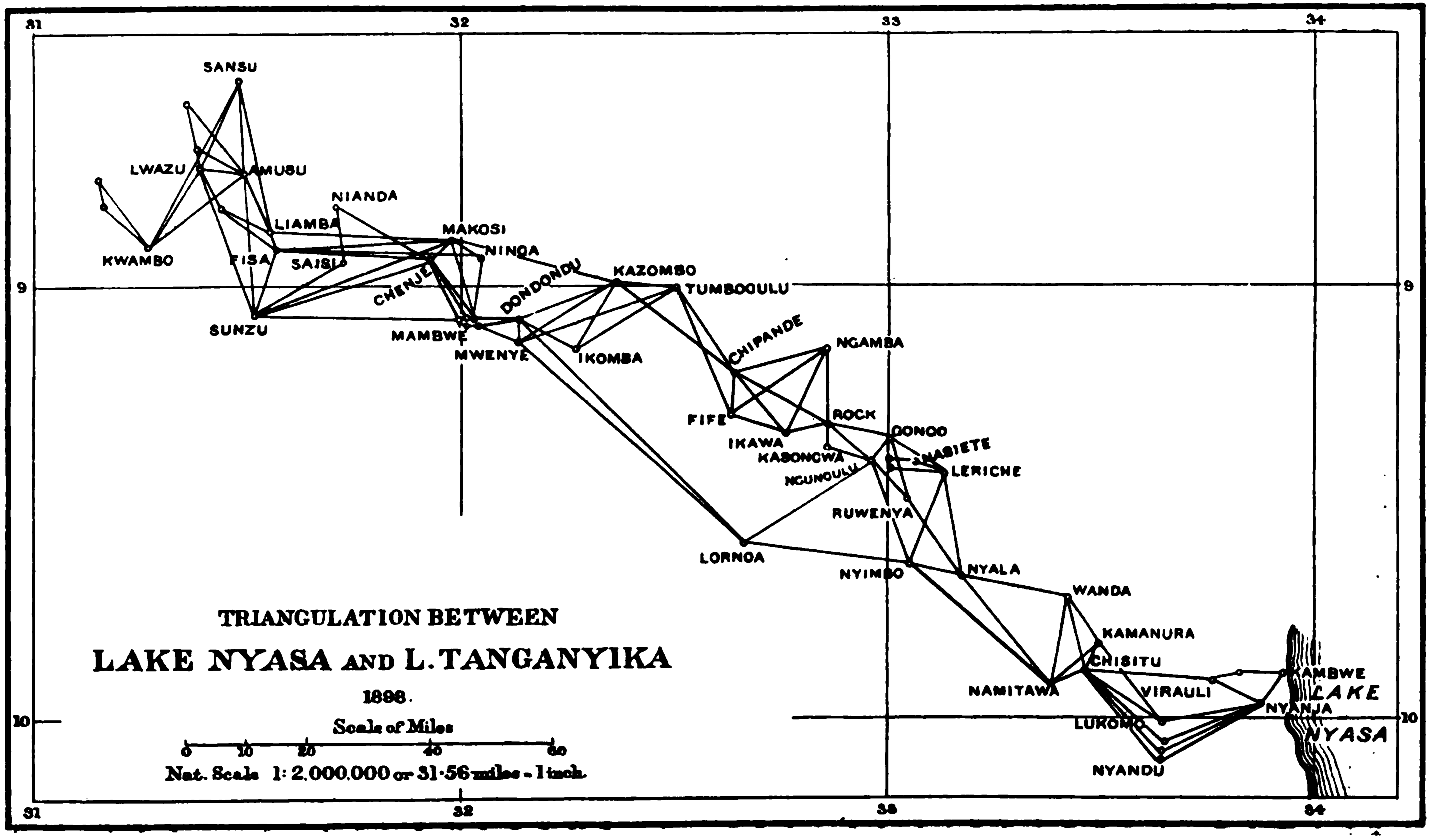
England, provided all the steamers connect, which is hardly probable. At least two and a half months should be allowed. As the so-called Stevenson road, which runs across the plateau to Lake Tanganyika and leads into the heart of Africa, commences at Karonga, this place is to us of some importance. It is the headquarters of the collector of the district, and here the African Lakes Corporation have a store, where a certain amount of calico, for payment of carriers, and provisions for Europeans can be purchased; stores, which owing to the increasing traffic to the Congo and interior should succeed, have just been opened by one or two Germans; a telegraph office has also been recently established by the Trans-continental Telegraph Company. There is also a branch of the Livingstonia Mission, about which I shall speak later.

Two large Belgian expeditions passed through Karonga last year. The first in June, under Monsieur Le Maire, who was to spend two years surveying and prospecting in the country between Lake Tanganyika and Stanley Falls. He sustained a severe loss in the drowning of two of his best officers while crossing Lake Tanganyika from Kituta to Mliro. The other expedition, under Captain Mohun, passed through in November. He is in charge of a telegraph line, which is to be laid through the Congo Free State. The Germans also sent a large expedition by this route to Lake Tanganyika. They were taking up a steamer which is to ply on the lake.

The drawback to Karonga is the want of a harbour where steamers can discharge their cargoes in rough weather. At present they are obliged to go to the Kambwe lagoon, about 3 miles further north, and unfortunately this shelter is fast being silted up.

The height of the surface of Lake Nyasa is 1700 feet above sea-level. The country rises very gently from the lake at about 1 : 150 to some low hills 5 miles westwards. Then a series of ridges, gradually rising, merge at about 40 miles from Karonga into what is called the Tanganyika plateau, which at the first camp (Kamanura) is 4500 feet above sea-level. The Stevenson road, the construction of which for the first 50 miles is due to the generosity of Mr. Stevenson, who presented £4000 towards this work, was well laid out through these low hills by Messrs. Stewart and McEwan (both of whom died while making the road), at a limiting gradient of about 1 : 10, and is about 10 feet wide. In the first 40 miles it crosses the Rukuru, Lufira, and Chambo rivers. From the latter a steep ascent brings one to Kamanura (which is merely a camping-place).

The distance by our triangulation of a point on the shore of Tanganyika at Kituta from a point on the shore of the Kambwe lagoon, on Lake Nyasa, is 203½ miles by a geodetic line. Therefore the plateau may be said to be 160 miles across. From Kamanura the plateau gradually rises to Mambwe, where it reaches an altitude of 5700 feet above sea-level. It then maintains a height of about 5000 feet till within 8



TRIANGULATION BETWEEN

LAKE NYASA AND L. TANGANYIKA

1898.

Scale of Miles

0 10 20 40 60

Nat. Scale 1: 2,000,000 or 31·56 miles = 1 inch.

miles of Tanganyika, when it falls rapidly to the lake-shore, which is 2680 feet above sea-level. The eastern end of the plateau is broken by high ranges, some of the mountains, like Namitawa, Miniwanda, and Inyala, rising abruptly out of it to an altitude of 6000 to 7000 feet above sea-level. But from Fort Hill to the Saisi the plateau is undulating, most of the pronounced peaks being to the north.

Between the Saisi and Lake Tanganyika the steep Fisa range rising on the road to 6000 feet has to be crossed to reach a sort of basin in which lies the Kawimbe mission. Thence onwards it again becomes monotonously undulating. The crest of the plateau, which forms also the watershed of the Congo basin, is roughly a line joining the north end of Lake Nyasa and the south end of Tanganyika. Towards the south it slopes down gently at an inclination of 20 to 50 feet to a mile, and is drained mainly by the tributaries of the Chozi and Chambezi, whose waters flow into the Congo. The northern slope, draining into Nyasa, Rukwa, or Tanganyika, is steeper and more broken. At 32° 40′ a spur runs out from this watershed in a north-westerly direction, called the Chingambo range, which, on account of its abrupt northern slope, has been taken by travellers as the real watershed, and is shown as such on most existing maps. This range, however, is cut by various streams from the real watershed south of it, which is perfectly distinguishable except in the neighbourhood of Ikomba, where a flat swamp draining both ways makes the determination of the watershed difficult.

None of the rivers in this area are navigable. At the end of the rains it is possible to ascend the Songwe for 2 miles in a boat not drawing more than 2 feet. A canoe can be paddled for a mile up the Kalambo, but otherwise the rivers cannot be used. On the plateau itself there is a great scarcity of water between July and November, especially at the eastern end. At most halting-places water is obtained from uninviting-looking stagnant pools. In fact, the only streams of any importance on the plateau are the Saisi and Lucheche. The former in the dry season is about 20 yards wide and 4 or 5 feet deep, and in the rains is about 200 yards wide. It is crossed by a very winding and somewhat shaky trestle bridge.

The Lucheche, a pleasant-looking mountain torrent refreshing to see after the succession of dry beds, draws its waters from a small lake close to the Abercorn. Towards the western end of the plateau many of the streams lose themselves in flat swamps, called "dambos;" these are treeless and dry in the hot season, and are often of considerable area, 10 square miles or so, and are the principal resort of game of all kinds.

The plateau is covered with a thin scrub jungle, with grass 4 or 5 feet high growing between trees 12 to 15 feet high. It is not sufficiently thick to prevent walking in any direction. At the eastern end almost every tree is covered with white ants, and this, together with the want of water, has probably stunted their growth. From Mpanga to within a mile or two of Mbala (or, as it is now called, Abercorn) the country becomes almost treeless, and the sense of relief on reaching these open downs after the endless bush before met with can be imagined.

On nearing Lake Tanganyika the trees are bigger and healthier looking, and are not attacked in the same manner by white ants. The real tropical jungle is only met with in patches on the Misuko range, and occasionally close to springs or where the water is not far below the surface. Just before the rains break, the leaves on all the trees turn to a bright brick red, brighter than our autumn tints, but at almost the first shower resume a fresh green colour. There are a few borassus palms on the plateau, and in the damp ravines on the northern slopes of Ngungulu, the rafia palm is common, and grows to a great height.

THE STEVENSON ROAD NEAR SAISI.

The soil of the plateau is mostly of a disintegrated granite. Round Ikawa there is a good deal of quartz and marble. The Fisa range is of a sandstone formation. Of gold we saw no traces ourselves, but our German friends told us they washed for it in most streams, and in many had found colour, but nothing more. Iron ore of a fairly rich quality is found in large quantities about a foot below the surface of the swampy plains at the northern end of the plateau. This the natives dig up, smelt in small earth kilns, and convert into wire, hoes, spears, and arrows.

At the western end of the plateau the rains begin in a half-hearted way about the end of October, while at Karonga, on Lake Nyasa, they begin about a month later and last till about the end of April or the middle of May. At other times, although absolutely rainless, there are occasionally cloudy days. The rainfall on the plateau amounts to about 70 inches, and at Karonga about 50 inches. The maximum temperature at the latter place is about 100° Fahr.—somewhat high—and the relief on getting on to the plateau, where it is only about 85°, is great. The nights are always cool on the plateau, and during June, July, and August, the traveller in camp will need three blankets over him. From June to September a strong and bitterly cold south-east wind blows day and night, giving rise to liability to chills, and making observations with a theodolite somewhat difficult. As in other tropical climates, the sun should always be treated as an enemy, and a good pith hat is desirable.

So far, the healthiness of the plateau has not had a very good reputation. The Boundary Commission suffered a good deal from ordinary malaria or fever sores, whilst among the European inhabitants there were several cases of blackwater fever. One of the German party had it, but recovered. Whilst the Commission was at work, five white people out of the scanty population of about 20 died, four of them from climatic causes. In favour of it, however, it should be added that this happened to be a particularly unhealthy season, owing to the extraordinary duration of the rains; also that there are several men there who have been six to seven years in the country, and, except for a somewhat anæmic complexion, do not seem much the worse for it.

Under no circumstances should the traveller sleep on the ground. This was well exemplified while we were there. Our two N. C. O.'s did it for three days; at the end one had very bad fever, although he had only been three weeks in the country, and had never been out of England before. We met a gentleman at Fort Hill who had bad fever. He told us that for three years in Southern Rhodesia he had slept on the ground, and had never been the worse for it. However, he had done the same on the plateau for the previous ten days, and had completely broken down.

It is hardly a country one would recommend the sportsman to visit for shooting purposes. Buffalo, owing to the rinderpest, have almost disappeared from the plateau, although round the Kalambo fresh tracks were seen. There are a few lion and rhino. Eland, roan antelope, hartebeest, zebra, and small deer are met with, but more down in the valleys to the north than on the plateau proper. A great deal of game is killed by the natives. They build a high fence of brushwood and felled trees, sometimes 3 or 4 miles long, with various sorts of traps at intervals of about 30 yards. The whole village turns out, and drives the game towards these, and at times they make very big "bags." The worst form of trap is the game-pit, which is 6 or 7 feet deep, with six sharp-pointed stakes in the middle. These are carefully covered over with a thin layer of brushwood and earth, through which the animal easily falls. To the uninitiated traveller they are a great source of danger, as they are exceedingly cleverly hidden, and are generally placed in the most convenient routes through those fences and through the jungle. One of our non-commissioned officers walked on to one, and was lucky to escape with only one spike through the calf of his leg, which caused him considerable trouble for many months. Of snakes there are various sorts, the worst of them being the puff adder, but they are not nearly so common as in India. The matikenia, or jigger, is found on the plateau, especially about Kawimbe. This unpleasant insect, somewhat smaller than a flea, gets under the toe-nail, and buries a little bag of eggs, which, though easily removed, sets up an unpleasant irritation. The natives, especially the children, suffer considerably from them. Another source of great irritation to the theodolite observer, but curiously enough only on certain hills, is a small fly, which settles in dozens on the unfortunate man; they run up his nostrils, get into his ears, and, unlike other flies, are not kept off by fanning; a fine veil is therefore advisable.

THE STEVENSON ROAD NEAR ILNOMBA.

The tsetse fly does not exist on the plateau. There have been three horses in the neighbourhood of Fife for some years now, and they are still a great source of wonder and terror to the native; they have no name, I believe, for the animal, but call it by the Portuguese name.

One native name for Lake Tanganyika is Liemba. The surface of the lake is 2680 feet above sea-level. The water of Lake Tanganyika, unlike that of Lake Nyasa, which is sparkling and delicious to drink, is insipid and tasteless. Captain Gibson, of the *Good News*, the small steamer on Lake Tanganyika, told me he always drinks it, but found it not so thirst-quenching as spring water. Hippopotami and crocodiles abound in the lake; the shore is covered with shells of various sorts, and Mr. Moore, a specialist who went up there about two years ago, found, chiefly, at considerable depths in Lake Tanganyika, a set of water-snails unlike anything elsewhere, and which he could only compare to certain Jurassic fossil forms. A curious thing on Lake Nyasa, but which I did not hear of on Lake Tanganyika, is the nkungu fly. It is slightly larger than a gnat, and rises in swarms, which in the distance look like clouds, off the surface of the lake. As they are blown over the land, natives hold up baskets to catch them. When they have caught a large quantity, they mash them up between their hands and roll them into balls and eat them. They are said to be most delicate.

Now a few words about the natives. Starting from Lake Nyasa, and marching west to Tanganyika, the following tribes are passed through: Nkonde, who are principally on the German side of the frontier; Namwanga, about equally divided on each side; Mambwe, about two-thirds on the English side; Urungu, almost entirely on the English side. The Fipa live somewhat north of the line between the lakes, while a large and important tribe called the Awemba lie some 70 miles south of the Stevenson road.

The boundaries between the tribes are not very definite. Villages of alien tribes are found in many places, and near the administration stations villages of mixed tribes have sprung up. The villages are very small as a rule; a village would ordinarily consist of 30 huts, and hold less than 100 men, women, and children. The largest villages are near the Saisi river. In this neighbourhood there are one or two villages of 200 huts or more, but there is nowhere on the plateau a village of 1000 inhabitants.

Since the arrival of the white man, the chiefs in the administered country have lost nearly all their power. The tribal organization, practically, does not exist, except with the Awemba. The headman or chief of a village is nearly powerless, except to carry out local customs or the opinion of the majority. Many villages are in process of disintegration by the formation of smaller villages out in the bush by the younger people. The population is nearly everywhere far smaller than the country can support. This is particularly due to the raiding of the

Awemba, a practice which has now ceased, but which went on as late as 1895. Internal fighting and sacrifice, though prevalent up to a few years ago, were not on a sufficient scale to materially affect the population. The density of the population in the neighbourhood of Fife is eight to the square mile; in the neighbourhood of, Mambwe, six to the square mile.

Before European occupation, villages were larger, the headman exercised considerable authority, and the chief of a village was a despot, but slightly controlled by public opinion. The Mambwe and Namwanga tribes separated from the same stock about eighty years ago. Even at that date the rigidity of the tribal organization depended on the personal ability of the dominant chief. Internal fighting was not uncommon. The paramount chief would put his sons or influential men, called "capitaos," in charge of important villages, and the brothers would not infrequently fight amongst themselves. The internal troubles were varied by raids from the Awemba. In a few cases the latter were beaten off, but usually the terror of their name was sufficient to send all the villagers flying into the bush at the news of their approach. It is not uncommon to see even now on the plateau men who have been mutilated by the Awemba, with hands, toes, nose, ears, lips, etc., cut off; this was done mainly to keep up their reputation. Mutilation

SONGWE VALLEY.

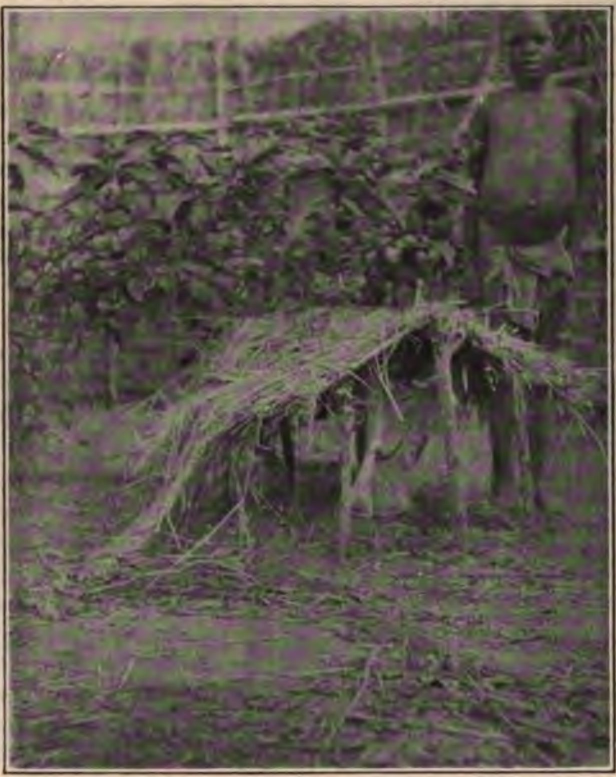
was a common punishment amongst all the tribes, but European intervention has put a stop to this; but in districts governed by native law, death is still the punishment for disobedience of the orders of their chief, but is not inflicted without the sanction of the collector.

It is interesting to record that last November a serious attempt was made to settle the Awemba country. About six months ago (September, 1898), Mwamga, the most important Awemba chief, died. Mwamga's village is about long. 32° E., and some 70 miles south of the Stevenson road. His death was, according to custom, kept secret from his people by his wives and headmen, and whilst his body was rotting in the hut the report was spread that he was ill. The idea appears to be to give the spirit time to seek some other habitation. The secret eventually leaked out, and in the ordinary course of events there would have been a sacrifice on a large scale, and the chiefs' wives and many of his people would have been buried alive in the pit where he was laid. The news came to the ears of Mr. C. McKinnon, collector at Ikawa and Bishop Dupont of the French Algerian Mission at Kayambe; independently, from different parts of the plateau, the collector and the bishop hurried down to Mwamga's to see if the opportunity could be taken of occupying this part of the Awemba country. The people, who did not seem to have been anxious to be sacrificed, welcomed them gladly; and the bishop by buying the interest of the minor chiefs, and the collector by a small display of force and authority, established themselves in Mwamga's, and an administration station is now being built, to the general satisfaction of every one concerned. Mr. McKinnon and Mgr. Dupont deserve the greatest credit for the way in which they seized the opportunity.

All the tribes mentioned, except the Nkonde, appear to have the same general religious belief. They have all the belief in an overruling god, spirit, or general providence, for whom their name is "Leza." In addition to this, there is the following form of ancestor worship, or rather relation worship. When any member of a family dies, the relations build a miniature hut near their dwelling for the dead man's spirit to live in. The hut would be about 3 feet high and 2 feet square. In this he hangs a rag of cloth about 15 inches long and 5 inches broad; this is for the spirit's clothing. He also places in the hut millet and beer (pombe) for food. The spirit is assumed to be so thin and unsubstantial that the accommodation and clothing are more than enough for it, so that one hut will do for a man's father and all the rest of his relations. These huts may be in or outside the village, and when a villager is in trouble, he will visit the hut and pray to his dead relations for help.

With the chiefs the arrangements are a little more formal. The praying-place is then usually on the top of a hill near the village, and the dead chiefs are in the position of protectors of the whole village.

In times of drought, prayers would be offered by the few old men of the village, the villagers having assembled and looking on at the ceremony, the chief of the village having no special function himself unless he is an old man. The idea is mainly that of the continuity of the spirit before and after death, and that those who have known the old chiefs have more influence with their spirits than those who have not. By a modification of these ideas, the Fipa tribe believe that their chiefs become snakes after dying, and the Fipa people worship any snakes they meet. The Mambwe people are acquiring a belief that their chiefs become lions, but this idea seems to be comparatively new, and is, anyway, less than eighty years old. An old man at Karonga, in particular, has a great reputation for working miracles. His first success was about six or seven years ago, when the locusts were bringing famine on the country. He retired to the Virauli hill to pray, and afterwards distributed some powder amongst the natives, with instructions to mix it with water and to sprinkle it over their fields. The result was perfect. The locust died



HUT FOR SPIRITS OF DEPARTED TO REST IN.

in thousands, probably really from some disease, and in a few days entirely disappeared, nor have they reappeared in great quantities since.

His second miracle was about two years ago, when the *Domira* ran ashore. For five days no human efforts would float her. He then asked if he might try, and, as he could do no harm, he was allowed to. He brought on board a white hen, and, after offering up a few prayers, threw her into the water. Next morning the ship was floated without the least trouble. Till this day the wind had been strong off the lake, but suddenly shifted to the opposite direction, which may have had something to do with it.

Their ideas are considerably more advanced than those of the West Coast of Africa generally. There are no ju-ju houses on the plateau, no juju ceremonies, no priests nor medicine-men. There is, however, a very general belief in witchcraft; it is private witchcraft worked by unofficial wizards, and the bewitched are treated with suspicion, and turned out of the village to explain their misfortunes elsewhere.

The negro is impulsive, sensual, emotional, swayed by personal influence, careless, and improvident. If kindly treated, he is grateful and trustworthy. Stealing, except amongst those who have been long in touch with civilization, is uncommon. Whether from a natural propensity or some higher motive, they are extraordinarily unselfish. Give a man, say, half a tin of potted meat or a piece of chocolate, however small, he will share it with his companions.

The natives carry from 45 to 55 lbs. on the head. In a march of 14 miles, they will do their 2½ to 2¾ miles an hour. They suffer considerably from ill-health if moved from their district. We took some carriers drawn from the south of the plateau, down into the Songwe valley. In a week, twenty or thirty of the hundred carriers appeared in the morning with a string tied round their heads, to denote that they were too sick for work. One day some of the carriers came round to ask for the loan of our picks to bury a companion who was dead. Their request was naturally granted, but shortly afterwards one of us walked round to look at him, and on removing the dirty piece of cloth which covered the body, found him alive, and thus only just saved him being hurried into his grave. He died, however, the next day. As soon as a native gets sick, he loses heart, and makes no fight for life. They have, however, great faith in European medicines, and I remember a chief being cured of an ague cold, etc., in three hours by a mixture of vermouth, whisky and quinine.

Almost all the natives go about armed with a short, nasty-looking spear. Some of them have guns, and a few still carry bows and arrows.

Some of their customs are curious. A native hardly ever passes a European without a "Morning fou," and at the same time slapping his thigh and bringing his hand up to the side of his head. On meeting their chief, they go down on their knees and bend their bodies until their heads almost touch the ground, at the same time clapping their hands softly. A commoner, when handing his chief anything, goes down on his knees. Sometimes a native, when addressing a superior, holds his hand before his mouth; this custom comes, I believe, from further south, in Mpezeni's country.

At the bottom of many steep hills small piles of stones are seen. Our interpreter told us that the carriers regard these as "lucky" hills. Before ascending with their loads, they pick up a stone, spit on it, and, after having rubbed the calves of their legs with it, place it on the pile. This, he told us, was to make their legs light; but he added, "It does not really do so, sir!"

RUMA'S VILLAGE.

The native is very musical. Their gamut is the same as ours. While a gang is at work, one man invariably sings a very pretty chant, the rest joining in the chorus, and now and then a man takes a part quite nicely.

On our march down, at Mambwe, we held some athletic sports, and all the neighbouring villages turned out to see the fun. At first they hung back like children, but at the sight of the prizes of bits of calico, beads, and more especially of pieces of soap being distributed, the people thawed, and men, women, and children entered by dozens for the various events. Even a heavy thunderstorm did not damp their ardour. During the interval caused by the storm the fair sex were entertained by light refreshments, which consisted of sugar done up in bits of paper. In the tug-of-war, the Awemba had a fine-looking team, but their leader, before commencing, came up and apologized for only having such a poor lot to represent them. I am glad to say they won easily.

A subject of interest to every one is the missions and their work; so a few words on the mission stations that we came across may not be out of place.

At Karonga, the Livingstonia Mission have built a big double-storied residence, with a dispensing-room and surgery. Besides this, they have a brick school and chapel. Mwenzo, 5 miles out of Fife, is another branch of the same mission, and consists of a homely brick house, occupied, while we were there, by Mr. and Mrs. McCallum and their child. The work here is purely industrial, and the boys are taught carpentry, gardening, and bricklaying.

Kawimbe, 25 miles from Tanganyika, is a station belonging to the London Missionary Society. This consists of three brick dwelling-houses, occupied by two lay missionaries (one of whom, Mr. May, had his wife there with him), a large church, and workshop. Here, as before, the natives are taught carpentry, brickwork, and smith's work, and very good is the work they turn out. Besides this, the ground round the mission is cultivated with all sorts of English vegetables and strawberries; also wheat is grown and ground by the mission and sold to the officials on the plateau. A large village has sprung up round the mission on their property. Any man is allowed to build a hut there, provided he complies with certain rules, one of them being that he and his family must attend church on Sunday. Mr. and Mrs. May and Mr. Robertson deserve the greatest credit for the splendid way they work, and the influence for good they have gained over the native.

Besides these there is a large Roman Catholic Mission at Kayambe, 30 miles south of the road. It is a branch of the French Algerian Mission, and the fathers, locally known as White Fathers, are three or four in number, assisted by some sisters of mercy and lay brothers.

Very rightly, all these missions pay great attention to industrial work, and the effect of this can hardly be overrated. I think that it is recognized by them all that it is impossible to catch a native and turn him into a Christian. The first thing is to raise their status and to develop their minds. The native has thoroughly recognized that education and speaking of English is the best road to opulence, and Mr. McAlpin, of the Livingstonia Mission at Bandawe, told us that in consequence of this, in the school there, and in the branches within the radius of 20 miles, the daily attendance was 6000 a day. This mission has an excellent system, namely, of enforcing the small payment of threepence per child for a session of three months; this, it is found, secures a regular attendance, owing to a feeling not altogether extinct among ourselves, of "having our money's worth," and consequently it gives the teachers a much greater hold over the pupils than if the teaching were given gratis. Time will not allow me to go much further into the subject of missions, but before leaving it one should mention the rock on which all missions split, and that is the wife question. If a native can afford the initial outlay, he will naturally keep three or four wives; and they till his field, tend the cattle, and look after his comforts, and are his willing slaves. It is generally taken by the native that monogamy is a tenet of Christianity, and the missions hardly allow sufficiently that it is not so much this as the necessary foundation of civilization, and that it cannot be insisted on before several generations have passed through the schools. At present, after the birth of a child, the man and his wife are temporarily and amicably divorced for three years. This strict and ancient custom cannot be swept away in a year or two. The chief interpreter to the Commission, a man of considerable ability, speaking English well, and once a pillar of the Church, has now relapsed to seven wives.

KAWIMBE CHURCH.

Now a few words as to the methods employed by Captain Close in fixing the initial longitude, and in carrying out the triangulation across the plateau.

At the time of the assembly of the joint commission, the Transcontinental Telegraph Line had reached a point near Nkata bay, about 140 miles by water south of Karonga, on the west shore of Lake Nyasa. The end of the wire was about 2 miles inland, and there the officials of the telegraph construction built a small camp of grass huts for the use of the Commission. The British instruments were detained by a breakdown of a steamer on the Zambezi, but Captain Herrmann very kindly allowed the use of the German instruments. Dr. Kohlschütter was the German representative, and to him was due the refinement of the result. The method used for determining the local time (after some approximate observations had been made) was that of equal altitudes of different stars.

The longitude party arrived at the camp on the 22nd of June, and on the evening of the 23rd we had the satisfaction of receiving two complete sets of signals from the Cape Observatory; and of sending one set, which was the authorizated programme. The signals came over about 1900 miles of wire, and the retardation was calculated to be slightly under the tenth of a second.

The 24th was cloudy, so observations for a time could not be taken; on the 25th there was a fault on the line near us; the 26th was a Sunday; on the 27th there was a storm at Salisbury, so that the wires could not work; on the 28th there was a storm between Salisbury and the Cape; on the 29th there was a fault near us; but on the 30th, after a week's patience, we sent and received excellent sets of signals, and the same again next night on July 1. The determination was now sufficiently exact. The longitude of this point, at which a pillar has been built, and which is in the middle of the telegraph clearing, is 2h. 17m. 7·6s. E. of Greenwich, and that of the shore of Nkata bay is 2h. 17m. 12s. E. The latter was deduced by a traverse. The longitude of the telegraph camp is not likely to be more than about one-twentieth of a second in error; it would, therefore, be desirable to treat this in future as the fixed point of this part of Africa. The position given on the map of Lake Nyasa in the *Geographical Journal* for December, 1898, which was compiled from observations of Lieuts. E. L. Rhoades and W. B. Phillips, R.N.R., agrees as nearly as the scale can show with this value. This would indicate that the received longitude of Blantyre, which depends on a very large number of lunar distances observed by Mr. O'Neill in 1884, is satisfactory, and until now all the longitudes of B. C. Africa have depended on this. But, of course, too much reliance must not be placed on an inference of this sort. The determination could not have been made except for the assistance of Mr. Rhodes, and the Transcontinental Telegraph Company, of Dr. Gill, H.M. Astronomer, Cape Town, and Mr. French, Postmaster-General; and we are much indebted to Mr. Broadbridge, at Blantyre, and all the gentlemen who assisted along the line.

For the triangulation, a base about 2 miles long was measured close to Karonga. The first extension was to two small hills 6 miles apart, on which beacons were built. From there it was possible to find the position of several hills, such as Nyandu, Lukomo, Virauli. We then marched on to Kamanura, but found that a high hill called Makongwa prevented us locating our position. We therefore went to Chisitu hill, and there employed a method which some of you may know, but for those of you who do not I will say a few words about. From Chisitu we saw three hills—Virauli, Lukomo, and Nyandu—whose latitude and longitude and mutual azimuths had been before determined. From one unknown position by observing to three known ones we could have interpolated our position, but this would not have given a check. So at Chisitu an azimuth was observed by the sun. Then, knowing the azimuth Virauli-Lukomo and reverse calculated azimuth Virauli-Chisitu, the angle at Virauli was known; in the same way the angle at Lukomo was found, and the angle at Chisitu, between Virauli and Lukomo, was observed.

Taking the other triangle, Virauli-Nyandu-Chisitu, and treating it similarly, provided a check to the length Virauli-Chisitu. One other value was obtained, and the three values were within 80 feet, which, in 20 miles for reconnaissance such as we were doing, was quite good enough. This method was employed several times, and much delay saved.

The triangulation plate (p. 579) shows the extension. There was some little difficulty in fixing Liriche, owing to the heavy haze due to the bush fires. This haze and clouds delayed the German party, who were carrying on a separate triangulation up the Songwe valley, some three weeks.

At Vimba, with Liriche and Ruwenya as fixed points, a fresh start was made and a new base measured, and the triangulation carried on by the hills on the crest of the plateau. Beyond Fife some little difficulty was met with, owing to the want of defined hilltops.

At Fife we were joined by the Wahid Ali Khan, who had been sent on ahead to commence the plane-tabling, and whose careful and accurate work was a great assistance. At Ikawa we met Mr. Wallace, who very kindly allowed us to copy his maps. We found them wonderfully accurate, and they were of great assistance to us in selecting hills for trigonometrical stations.

Another method to which I would draw attention is a method of plane-tabling when in advance of the main triangulation. Working at a small scale of 1 : 250,000, or nearly 4 miles to an inch, as we did, the intersections on the plane-table were sometimes very acute. With a small theodolite two angles of the triangle were observed, and the lengths of the sides calculated, and these lengths plotted on the rays taken on the plane-table. The mean position between these two points so found was taken as the required point. Compasses, except for rough traverses of paths, were of little or no use. The variation was found to be about 12¼° W. On some hills, bearings taken from points a few yards apart were found to vary by 5° and more. This was probably due to the iron in the soil, and other unknown local attractions. We found the position of a point on the shore of Lake Tanganyika, at Kituta, to be lat. S. 9° 21′ 11″, long. E. 32° 59′ 27″. The triangulation work was commenced on July 11 at Karonga, and finished at Tanganyika on October 20. We were much helped in the general carrying out of the work by the officials of the B.S.A. Company, especially by Messrs. C. McKinnon, Andrew, and John Law.

The time for rough and ready work in Africa has now gone by, and with the facilities offered by this Society for learning triangulation and sufficient astronomy to adopt the above methods, travellers should be able, without much loss of time or trouble, to carry out work of an accurate description.

LIST OF LATITUDES AND LONGITUDES AND HEIGHTS OF TRIGONOMETRICAL STATIONS, NYASA-TANGANYIKA BOUNDARY.

Name of station.	Latitude S.			Longitude E.			Height above M.S.L.	Remarks.
	°	′	″	°	′	″		
Lake Nyasa	—			—			1700	Surface of lake.
Kambwé lagoon	9	54	0·5	33	56	4·5	—	
Virauli hill...	9	55	18	33	45	14	3718	
Lukomo hill	10	1	24	33	39	5	6046	
Nyandu, north	10	3	35	33	38	54	6506	
Nyandu, centre	10	4	24	33	38	41	—	
Nyandu, south	10	4	50	33	38	51	—	
Chisitu hill, east knob ...	9	52	40	33	27	56	5728	
Kamanura hill	9	49	37	33	30	6	4712	
Namitawa peak	9	54	56	33	22	51	7239	
Inyala, north hill	9	39	46	33	10	50	5541	
Nyembo hill...	9	38	12	33	3	5	4971	
Liriche hill	9	23	53	33	8	24	6978	
Wanda hill, west rock ...	9	43	2	33	25	26	6176	
Ruwenya hill	9	29	45	33	2	45	6438	
Vimba hill (Gongo) ...	9	20	34	32	59	45	5090	
Kasongwa	9	20	49	32	53	6	5666	
Londa peak	9	34	53	32	39	40	—	
Chipande hill	9	10	52	32	38	13	5565	
Ngungulu hill	9	24	4	32	57	37	6507	
Ngamba hill	9	7	22	32	51	38	6270	
Tombogolo hill	9	0	0	32	30	20	5869	
Kazombo hill	8	59	25	32	22	26	5634	
Dondondu hill	9	3	57	32	8	31	5509	
Ikomba beacon	9	8	8	32	15	53	4817	
Mwenye hill	9	7	11	32	8	7	5131	
Mambwe tree	9	4	18	32	1	46	5711	
Makosi hill	8	52	54	31	59	35	5801	
Chenje hill	8	54	37	31	55	57	5470	
Ninga hill	8	54	16	32	2	23	5698	
Saisi crossing	8	55	46	31	43	56	5153	
Sunzu hill	9	2	50	31	30	38	6889	
Fisa beacon	8	53	43	31	33	58	6296	
Liamba hill...	8	51	30	31	33	10	6336	
Lwazu hill	8	42	13	31	24	20	6067	
Sansu pyramid	8	30	1	31	28	50	7393	
Chambanenje hill	8	46	54	31	10	42	3802	
Pillar on shore of Lake Tanganyika at Kituta	8	45	48	31	10	56	2680	

In conclusion, let me say that on return to England many people seemed to think we had been through many hardships and risks. As far as the inhabitants are concerned, there is no more difficulty than there is here. One day, while encamped close to the road beyond Fife, our boy put his head into the tent and muttered the magic word "Donna." This turned out to be Miss Caddick, who was travelling up to Tanganyika for pleasure. This she successfully did without any more serious adventure than an interview with a surly chief, who would not supply carriers. He came off second best.

II.

By L. A. WALLACE.

My travels in Central Africa were undertaken more for the sake of sport than for the exploration of the country, and in the fitting out of my expedition, the question of my battery was of more interest to me than what instruments I should take for survey or scientific purposes. Nevertheless, I included in my outfit a sextant, watches, compasses, barometers, and thermometers, and all such instruments as I knew I should need for the purpose of mapping astronomically, and by routes and bearings, all the country I might pass through. I also took an 8-inch theodolite, which I used for the purpose of determining absolute longitudes by moon culminations and occultations of stars. The absolute longitude of Abercorn, which was the point of departure for all my expeditions, has, however, since I left there, been fixed accurately by the Anglo-German Boundary Commission, and the longitude which I assumed for it from my observations will probably have to be slightly altered.

In July, 1896, I arrived, by Lake Nyasa and the Stevenson road, at the British South Africa Company's Station, Abercorn, 14 miles south of Lake Tanganyika, and on the high plateau 2800 feet above it. Here, through the kindness of Mr. Marshall, the collector, I was enabled to get a house built, in which I could spend the rainy months of the year, and from which I could start at the beginning of each dry season on any expedition I might wish to make. One season I shot near Lake Mweru and on the Mweru marsh, another season around Lake Rukwa, and during a part of the third on the river Chambezi. In the rainy seasons, I made many smaller expeditions in the country round Abercorn, surveying and taking observations from time to time.

The Tanganyika plateau, which is almost entirely included in British territory, has been often described. Close to the Anglo-German boundary it ends abruptly in a steep fall, called Chingamba by the natives, of from 2000 to 3000 feet to the river Songwe and the Rukwa plain in German territory. It falls very slowly towards the south, and in that direction keeps at an altitude of between 4000 and 5000 feet for

200 to 300 miles. The Stevenson road, which connects Lakes Nyasa and Tanganyika, and which for the greater part of its length is over 5000 feet above the sea, with points where it reaches 6000 feet, runs along the northern end of the plateau. Near it some of the highest hills attain the altitude of very little, if anything, short of 7000 feet, and form part of the watershed between the Atlantic and the Indian ocean. The streams which flow down the Loangwa and Lake Nyasa run into the Zambezi, and those which flow down the Chambezi and Tanganyika into the Congo. This watershed continues northwards as a still high ridge, which in some places becomes a range of mountains, past the east and north of Tanganyika, and joins to that other high plateau which contains the Victoria and Albert Nyanzas and the Ruwenzori mountains, whose waters go down the Congo and the Nile.

The tribes inhabiting that part of this plateau which I visited are the Atawa, between Lake Mweru and Tanganyika; then south of Tanganyika, the Alungu; and further eastward of them, the Amambwe and the Ainamwanga. North of these, between Tanganyika and Rukwa, are the Afipa; and south of all is the dominating tribe of the country, the Ayemba, as the Amambwe call them, or the Babemba, as they call themselves. There are also two large Arab settlements, one at the mouth of the river Luvu, on Tanganyika, and one near the Mweru marsh, amongst the Atawa. The most easterly of these tribes, the Ainamwanga, and the Ayemba south of them, extend nearly to the watershed between the rivers Loangwa and Chambezi. The Scottish Free Church Missions have for some years had stations in the country further east and nearer Nyasa.

The Ainamwanga and the Babemba are each under the rule of one supreme chief, and the Afipa are split into two sections; but amongst the Amambwe, the Alungu, and the Atawa, there are almost as many chiefs as villages. The Atawa were being broken by the Arabs when Livingstone was near Mweru in 1867, but the Alungu and Amambwe had been split up long before, and in their weakened state were an easy prey to the well-organized Babemba, who considered them their subjects, and raided amongst them yearly for their tribute of corn and cattle, and for men, women, and children to be sold as slaves to the Arab dealers.

It is among these weak and shattered tribes that the white man has been able to settle. He has been, in fact, welcomed for the sake of the protection the natives hoped he would give them against their enemies. Certainly his presence has been a protection to them, but it is certain, also, that but for their protection of him he could not have settled on the plateau at all, except at least with a considerable show of force. He has not been allowed to build in Lobemba, and the few white men who have been in that country have never been permitted to stay there more than a few days. The Babemba now, however, are rapidly breaking up themselves, and probably without any or with very little opposition the white men will settle soon amongst them.

Until quite lately, any white man settling down on the Tanganyika plateau would be certain to find, in a short time, a number of natives who with their families wished to build a village near or round him, and his house and their huts would be built within the same enclosure, and in such proximity as his tastes might decide or his carelessness allow. These families would consist of people who could not agree with their own chief, a rather large percentage of wastrels, and refugees from other tribes, all of whom would settle with him for the sake of his protection. On the other hand, he would be glad to receive them for the sake of the labour he would be sure to need. They, with the men he may have brought into the country with him, would become his people, and he would be their chief as far as he knew how, and as long as they remained in his village. The chief of a village has a right to what labour he may reasonably want, and the amount he can obtain depends on his people's respect for him and on his power to enforce his demands. A white man may insist on his people working, but he must pay for their labour at the current wage, which is at present a few yards of calico per month, with food or an extra yard per week to buy it. All the Government, missionary, and trading stations have been formed in this way.

Living as I did a great portion of my time at Abercorn, which is just near the boundary of the Alungu and Amambwe, all my personal servants and nearly all my carriers came from these tribes, though in every caravan I took out there would be some men from other districts. A few of the boys of these tribes have been taught to cook and do house-work by the ladies of the different mission stations. With one of these boys as cook, others quickly learn, and as the young boys take well to house-work, I soon had a staff of tolerable servants with whom I could travel with some degree of comfort. My headquarters being near the magistrate's station, I had no need of a village, and consequently allowed but few people to settle in the enclosure—enough only to provide me the few boys I needed to keep the place clean, look after the garden, or accompany me on any small expedition of a day or two at a time, which I might wish to make during the rainy season. For longer expeditions I always sent out to the villages around for men, and I was never short of the seventy or eighty I required.

Travelling with a white man on a shooting expedition, with the prospect of plenty of meat, and the certainty of returning home before the time for cultivating began again, was to the native youths the most enjoyable form of work during the winter months, and I always found that on the morning of my starting there were many more men to receive loads than I had loads to give; but as I had practically sent for them, it being impossible to tell each village how many to send, I always took them all, and for this reason my caravan was much larger than was necessary. I had, however, the advantage of being able to carry with me everything I could want for my comfort, and the spare men were generally useful for carrying extra food and even water occasionally, and the meat of game killed on the march. Often, too, a few women would accompany their husbands to carry their food and cook for them, and always there was a fair sprinkling of children.

On my first journey from Nyasa to Abercorn, all my carriers happened to be under a headman, who was the son of a Mambwe chief. He collected fresh men and continued the journey with me that year to Mweru, and afterwards came to look on the leadership of my expeditions as belonging exclusively to himself. He was an intelligent man, with a certain amount of authority amongst the Amambwe, and, being of chiefs' blood, was received well everywhere, and saved me much trouble amongst the carriers. He always helped to get the men together for an expedition, and I was therefore fortunate in always having the same headman and many of the same carriers every year. They soon got into the way of finding out and telling me the names of the rivers, mountains, villages, etc., which we passed, and of giving me such other information as they knew I was likely to want, and I am afraid that some were not above occasionally shamelessly inventing such names and information rather than own their ignorance.

It is never wise to rely too much on African natives, as they are quick to say what they think will please, and to lie to save themselves trouble, and, should they be in the least suspicious, no questioning is likely to elicit much information, and certainly but little that is true. When, however, they become after a long time accustomed to a white man's ways, and not suspicious of his intentions, they will often talk well and sensibly to him of their history as they know or imagine it, and of their beliefs and customs.

After travelling with the same men for months, and camping always in the same temporary enclosure, with no white companion to talk with over the camp-fire in the evenings, a certain friendly familiarity becomes established, and I was always glad when some of the men learnt to come as a matter of course to sit and talk round my fire, not necessarily to me, though there might be an introductory question as an excuse for the gathering, but quite unaffectedly amongst themselves about their own affairs or the incidents of the road and the people we had met on the journey. The women round another fire told stories to such of the children as had not preferred to climb on their father's knees to hear the men's talk, sang songs in turns, vied with each other in attempts to hurry through, without taking breath, some rhythmical jargon of words like our Peter Piper and his pickled pepper, and played or taught one another games, some of them, like cat's cradle, the same that are taught to children in English nurseries.

In listening to some of their longer songs and stories, I perceived that the form of words was never changed, and on inquiry it appeared to me that these forms of words were not fully understood by the people who used them. It may be that these set phrases are remains of an archaic language used in songs and stories which have been handed down orally through many generations, or that they are the remains of a language which was brought into the country by some movement of population. Some support is given to the latter view by the fact that, as I subsequently ascertained, some of these set refrains, which were not understood by the people who used them in the country in which I was travelling, formed part of the current language of other tribes much further south. The whole subject is interesting, but I had neither the opportunity nor the knowledge requisite for thoroughly investigating the matter, which will no doubt form a subject of inquiry hereafter.

It is easy, especially with the help of a small vocabulary, for a traveller to learn enough of a dialect for his immediate necessities, and soon to talk about common things should be no difficulty, but to understand the talk of natives amongst themselves requires years of residence amongst them. An interpreter is very necessary at times, and is useful to ask some simple questions which admit of a simple answer, though one soon learns to do that for himself; but to get the talk of the camp-fire translated is impossible, and I have always found that a narrative, which has taken half an hour to relate in a native language to an audience which showed considerable appreciation of its many points, is translated by the interpreter into less than a dozen English words which have little meaning and absolutely no interest at all.

The question of languages is a great difficulty, for there is a fresh language or dialect in every small tract of country, and even in the short distances I travelled, before I had learned any native language at all, I often had to understand what was said to me as best I could through two interpreters. The principal languages on the higher plateau are: (1) Chi-mambwe, which is spoken by the Amambwe, and with very few differences by the Alungu and Ainamwanga, and is understood by the Afipa. (2) Chi-bemba, spoken by the Babemba, of which that spoken by the Atawa is but a dialect. There is no similarity between Chi-mambwe and Chi-bemba, though there are many men in each tribe who speak both languages. A small grammar and vocabulary has been compiled by the London Missionary Society of Chi-mambwe, and the Fathers of the French Mission are at work on another, on the language of Lo-bemba. These two languages are sufficient for all the northern part of the plateau under the rule of the British South Africa Company (Lo-bemba = the country, and Chi-bemba the language of the people Ba-bemba; the Amambwe would say Lu-yemba, Chi-yemba, and A-yemba).

It was in my shorter expeditions from Abercorn that I travelled over the country south of Lake Tanganyika, and was able to map it between the rivers Luvu and Chambesi down to 10° S. lat. I journeyed through much of this country two or three times, and once through the northern part of Lo-bemba, and heard there a little of its recent history. I was astonished to find how well the boundaries of the land were known, not only between the tribes, but even those between the ground of small sub-chiefs, and there seemed no land whatever that had no owner.

It is not thickly populated, for though there are places like the Upper Saisi and the Lower Luvu, which carry many villages, there are also large stretches where there are no villages at all, and between the Babemba and the tribes to the north of them there is a piece of depopulated country of quite 120 miles long by 20 miles broad, where not a soul is to be seen. This country belongs mostly to the Alungu and Amambwe, but they were driven from it by the Babemba, who occupied it by a few outposts, which, however, they withdrew when the British South Africa Company first opened a station at Abercorn. The whole of this strip is on the finest part of the plateau, but in spite of this and of the great love the natives have for their own piece of country, they are still too much afraid of the threats of the Babemba to return, unless the Government will send some white man to remain there with them.

The villages are well built, but not always well kept, and around them are the gardens where their green food and root crops are generally grown. The fields for corn are in the bush, sometimes miles away. The people are industrious when occupied with their own affairs, and the work of the community is fairly divided. The building of the huts is the men's work, with the exception of the plastering of the sides and the making of the floors; this the women do. The hard work of the cultivation, such as cutting bush and fencing or ditching, is done by the men; the hoeing, weeding, and reaping is entirely the women's work. The care of the corn, the making of flour, and the cooking of food, besides all house-work, is the women's work also; but it is the men who make the clothes.

There are very few cattle amongst these people, but what there are the men look after, while the boys help to attend to the goats and sheep, and the girls learn cultivation, cooking, and good manners from their mothers. In fact, during the time of cultivation and harvest there is a good deal of work for men, women, and children, and it is difficult at that time for a white man to get labour for any work he may want done for himself. But during the dry season, when village work is scarce, the men turn out to do the transport of the white man's goods across the plateau, make his roads and bricks, and build his houses, so earning enough cloth and beads both to keep them and their families in clothes for the year, and to trade with other tribes for hoes, salt, axes, and the many things they need which are not made in their own villages.

In most villages some men employ themselves in making reed or grass mats, baskets, etc., and some of the women in making pottery, and as places often far apart are noted for making some of these things better than others, there is a constant movement of trade between them. Amongst the Atawa, the people on the Mweru marsh are engaged in making salt; the Afipa, noted workers in iron, make hoes and axes; and all the villages on Rukwa weave cotton cloths; and in all these things there is an inter-tribal trade. The Babemba produce nothing, and to pay for their imports, formerly were in the habit of raiding the neighbouring tribes and selling the captives as slaves to the Arabs. A cloth, 4 yards of calico, a load of salt, a hoe, and a slave, were all units of equal value, and are nearly so still, though the slaves are no longer currency except in Lobemba. This unit is called an "mpanga," but I have only heard the word used in connection with the settlement of disputes or the buying of a wife, for whom from four to ten "mpangas" might be paid. These would be made up of calico principally, for this is easiest now to obtain, but a hoe and a load of salt might be insisted on.

Iron is smelted from a rich hæmatite ore in high blast furnaces, strongly built of ant-heap mud and heated by charcoal. It is a trade confined to few families only, who have the necessary "medicines" for success, and who know the rules which have to be observed. They are certainly very good tradesmen, and turn out in hoes, axes, and knives some very creditable work, but it is the "medicine" which gets the credit of the skill. One of the missionaries once tried to smelt iron, and his attempt was watched with interest by the natives. He could not get up enough heat, and failed. He might have had the correct "medicines" (crocodile gall is said to be one), but he did not observe the rules; any tyro could have told him that it was impossible to smelt iron and continue to live at the same time with his wife.

Medicines and witchcraft enter largely into the native's belief here as in all other parts of Africa, and, with the spirits of his ancestors, form the principal bases of his religion. Amongst all the tribes I have mentioned, there is the word "Mulungu," which has been interpreted "God." What idea Mulungu conveys to the native's mind, I doubt if any one knows, and one would have to possess, not only a great knowledge of their language, but also a very unbiassed mind, to have any chance of finding out. Missionaries have now for a long time used the word in their teaching, and the natives, I fancy, have been quite willing to accept their explanation of "Mulungu." Mulungu certainly was not a god whom it was necessary to worship or propitiate, or, in fact, to be taken into account at all, any more than any other accident of nature with which men have no personal concern. Prayers and offerings are given to those who are considered to have a more immediate interest in the supplicants—that is, to the spirits of their ancestors, and generally to those who have most recently died. Every tribe or section of a tribe has its praying-place situated mostly on some high hill, and there the chiefs pray and give offerings to their dead ancestors. At almost every village some miniature huts will be found, in which are offerings of water, flour, and cloth. I remember, on my last expedition, my headman telling how he had been with offerings to his dead father, to pray before he started out, and had begged him to go in the path before him, to see that no harm befell him by the way. It was distinctly the spirit of his own dead father to which he prayed, and, in answer to my inquiry, he asserted that he would curse him when he got back if his petition had not been granted. The Babemba have, perhaps, something more resembling worship than the rest, and are the only tribe I saw who have a high priest, or indeed any priest at all. This priest lives at the burial-place of the royal family, and there keeps the idols or gods, which are held in considerable reverence. The Babemba also have many more of the small huts for offerings near their villages, but I had too little intercourse with them to learn much of their ways.

I have sometimes heard natives say that it is only chiefs and people of their blood who live after death as spirits or animals; the common people die, are buried, and that is the end. Respect for people of chiefs' blood is certainly great, and for this reason a chief is able to keep round him a following of good headmen, who work with him, and plenty of young men willing to get favour by doing his bidding. He is thus generally strong enough to punish offenders or enforce his will. Offences are, however, generally only against himself. Against the community there are few crimes—murder, theft, and adultery being entirely questions between the persons or families immediately concerned, and no one else's affair. Disputes arising out of these questions are judged by the chief when referred to him, and settled, as a rule, by payment of damages. These disputes seemed to me to be dearly loved by the general run of native, and the subject of them ranges from libel to murder. There is a settled mode of procedure. The disputants and their witnesses seat themselves on the ground before the chief and his headmen, generally surrounded by at least half the inhabitants of the village, and, after a few minutes of salutations and talk of other things, the claimant opens the case. Beginning its history from perhaps many years back, quietly, fluently, and most impressively, he carries his story through to the end, his face a changing picture of the emotions which all honest men must feel at hearing such a tale. Without faltering anywhere, without hesitation, his story bearing the evident imprint of truth, he answers quietly any questions put to him by the chief or headmen in order to clear some point, or claims immediately his right to speak without interruption, if any but the chiefs should address him. Occasionally he lightly tosses a small stone to his opponent to mark each point as he makes it, and these stones will be thrown back to him by the defendant stone by stone when his turn comes to state his side of the case, which he will do equally fluently, equally plausibly, and point by point will refute the claimant's story, and seem to wonder, perhaps in sorrow, how any one could bring himself to lie so deliberately. Witnesses also state what they have to say without interruption, and then questioning and talking may become general amongst the whole crowd, until the chief gives his decision or postpones the case. He knows the disputants, and probably, if the case is important, he also knew all about it long before it was brought to him, and decides a good deal on this knowledge. There is no appeal, and the decision seems to be generally accepted. These cases are called Mi-landu, and need not always be brought before a chief, and may be only a friendly meeting of disputants to try and settle a case either amongst themselves or before appointed arbitrators. The chief, however, is the ultimate court of appeal.

Marriage is by purchase, but this does not mean that girls are sold like chattels or slaves to any one who needs a wife. There is a good deal of ceremony to be gone through, always commenced by a friend of the would-be bridegroom, who opens negotiations with the parents of the girl; if the marriage is considered desirable by the parents and agreed to by the girl, a meeting is then arranged between the two families, and terms and date are fixed. On the day fixed, there is feasting and dancing in the village, the girl is handed over to her husband, and after they have gone to his hut, singing and dancing are still kept up by their friends far into or even throughout the night. The wife is then the husband's property, and by arrangement with her and her family he could give her to another, but not against her will. Giving away wives, however, is a luxury only to be indulged in by chiefs, who, besides those of their own choosing, may have inherited more from their fathers or brothers, and though a woman may be proud to be owned by a man who is rich enough to keep a good number, still it is not pleasant to be one of the least considered, and she is not likely to make any dispute about being given in marriage to some other man who will appreciate her more.

A man seldom abandons a wife, for he would lose the price he paid for her; but he could claim this price to be repaid him if the wife deserted him. By mutual agreement also they can separate, and if the price is paid back, the man has no further claim on the woman. Few women would lightly leave their husbands, for to have no man to whom she belongs is not considered by any means an enviable position by a native woman. There are some cases where, if a wife dies, the family have to find another in her place; but this is probably only an abuse introduced where one tribe, or even some family in a tribe, is much stronger than its neighbours. If a story which was told to me by the natives is to be believed, the abuse has been carried so far that almost a whole family, for want of women to supply the place of those who had died even of old age, had in the next generation become the slaves of the family into which one of their daughters had originally married.

Mothers and fathers are often known by the names of one of their children, and, dropping their own names, become, say, Nina-mweya and Si-mweya, or the mother and father of Mweya.

For counting, the people have numerals up to five, and a word for ten, but the words for six, seven, eight, and nine are borrowed from Kiswahili. I once saw a man selling bracelets by the hundred. To count this number, he first counted two heaps of five each, and, joining them, called them ten; again two fives were made into another heap of ten; and so on till there were ten heaps of ten bangles each, and these all together he called "Mwanda," or a hundred.

All the people are tattooed, and each tribe has its own tattoo marks. Some, for instance, have a couple of horizontal lines tattooed on the temples, and one vertical one down the centre of the forehead; others, besides tattoo marks, have the two front teeth knocked out of the lower jaw. The Amambwe women cut holes in the lobes of the ears and insert plugs, which are constantly being made larger and larger until they become flat discs, commonly an inch and a half in diameter, and often even more. Some of the Alungu women have a small hole through the upper lip, in which they insert a short stalk of dry grass, but never one thick enough to distend the lip after the manner of the Manganja tribes as described by Livingstone; and near Rukwa I saw some women with a small brass ring instead of a piece of grass in the upper lip. Men and women are all tattooed over the body, apparently merely for ornament. The Babemba do not in any way mutilate their bodies, beyond the ordinary tattooing, but among them every village has a large number of terribly mutilated inhabitants, who, as a punishment for some offence or to gratify a chief's whim, have had their eyes gouged out, or their ears, lips, noses, or hands cut off, and a few are always to be seen who have survived after having suffered all these mutilations together.

Their principal amusements are dancing, singing, and music, in which drums take the principal share, though they have various stringed instruments of up to three strings, many forms of rattle, and the Afipa have flutes. They have far more idea of music than any other natives I have heard, and many villages have their professional singers and dancers, who at one time of the year travel about the country in bands, singing and dancing at every village, and receiving payment for doing so. At every village of any pretension a night seldom passes without some dancing, and often the whole population seems to be up half through the night; this is especially the case after new moon, which is always eagerly looked for, and little knots of people are often seen watching for it in the evening, all anxious to see it first.

What I have said about the people applies more particularly to the Amambwe and Alungu, amongst whom I lived most, though in my longer journeys I saw something of other tribes and of the country around Perhaps the most interesting place to which I went was Lake Rukwa, or Hikwa, which till my visit had not been explored, and little was known about it. As I spent some time on it, and was not only able to walk round it, but also to make a survey of it, I propose to give some description of it here.

This lake is a shallow salt lake in German territory, nearly 100 miles to the east of the southern end of Tanganyika. Mr. Thomson saw it in 1879, from the hills above to the west; Kaiser, later, reached the northern part of the plain in which it lies; Sir Harry Johnston and Dr. Cross visited the south end, but were unable to reach the open water; and Mr. Nutt, a missionary, reached it where the river Saisi runs into the lake on the west, but, for the want of drinking-water, was unable to proceed further. No white man had visited the east side, and it is doubtful if any one had got to the open water at any point before I took my expedition there in the dry season of 1897. I went there hoping that I might find elephants and enjoy some shooting in a quite new country; but, owing to illness, I was unable to stay as long as I intended. There were, however, no elephants there, and I spent the greater part of my time in exploring and surveying the lake. Before starting, no information was to be obtained about the country, whether food or water was to be had, or even whether people lived there; so, with a larger caravan than usual to carry food, I decided to follow the course of the river Saisi, so as at least to keep near water on the way to the lake.

The river Saisi rises near the highest parts of the Tanganyika plateau, on Mount Sunzu, 6300 feet above the sea, and about 70 miles from its source drops over the edge of the plateau 2000 or 3000 feet in cascades and waterfalls to the Rukwa plain. From the foot of the hills it has cut for itself a gulley about 40 miles long, from a quarter to half a mile wide and 100 feet deep, with steep and sometimes perpendicular banks, through the old deposits of sand and clay which were in far-off times perhaps a delta at the river's mouth, but now form the plain. In this gulley the river continues, the banks gradually lessening in height until they disappear where it falls into the north-west corner of Rukwa through swamp and thick jungle, near a village called Senga. It was to this point that Mr. Nutt reached when, fearing the want of water, his men would take him no further. Staying here two days to hear all the natives would tell me, and to see what I could of the lake, I heard that there would be little difficulty in walking round it, and, better still, some men from Senga were willing to accompany me to some villages at the south-east, where I should be able to get more who would go still further round with me.

Leaving Senga, I travelled for three days a zigzag course about 45 miles south-east to the river Songwe, with the lake-shore on the left, and on the right the bush-covered plain, which rises almost imperceptibly from it towards the mountains. I could not, however, always keep close to the shore, for fresh water near it is scarce, and that of the lake is so salt as to be undrinkable. Between Senga and the Songwe two streams flow into Rukwa, but only carry water during the rainy season. In the winter at certain places, not everywhere, in their beds water is obtained by digging, and near most of these places is a small village of a few huts only. On this part of the shore the bush of palms and thorns sometimes reaches quite to the water, and sometimes the lake is fringed by wide grass plains, on which, at varying distances from the shore, is often a distinct bank 5 feet or more in height, from which one could see well over the lake. It did not seem to me as if the water often rises above this bank, but for some months of the year it probably laps against it. Below it, and reaching to the open water, was a narrow strip of swamp or a wider stretch of dried mud, which, when trampled much by game or by the many feet of my rather long caravan, hung above the ground in clouds of suffocating dust. The water was shallow, of a grey mud colour, and very dirty and salt. Crocodiles and wildfowl were in abundance, and game and lions were plentiful, and seemed to drink the salt water, for their tracks to drinking-places on the lake were well worn.

At the south end, the Songwe, a stream half as large as the Saisi, enters the lake. It was here that Sir Harry Johnston and Dr. Cross tried to reach Rukwa. They were unfortunate in striking it near where one of the larger rivers runs in, and where the swamp caused by it makes the approach to the lake difficult. From this cause Sir Harry was under the impression that the whole lake was surrounded by an impenetrable belt of reeds; but only a few miles from the river, on either side, is a long extent of easily accessible shore at the edge of the open expanse of water. Only at the river mouth did I see any dense belt of reeds which separates the open water from the firm land, and on the north-east shore the water generally ends at a sandy beach, on which the path lies, or at the base of steep cliffs which, sometimes nearly perpendicular, rise 450 feet out of the lake.

Close on the right bank of the Songwe these hills begin, and in an unbroken and almost straight line they form, for the whole 100 miles that I travelled along them, the north-east boundary of the Rukwa plain, which they close in with a precipitous face of from 200 to 500 feet in height. Close behind them are many higher hills, the most conspicuous being the massive peaks of Mounts Kuimba and Ilomo.

For the first 20 miles from the Songwe the water of Rukwa washes the feet of these hills, and the path only descends from them to the shore at Chipindi, Njira, and Chiubi, small villages on the deltas of streams which in summer fall in at these places. At Chiubi the open water of Rukwa ends, and its place is taken by a wide open grass plain, along which the path continues for the next 60 miles close to or in the narrow fringe of bush which lies at the base of the cliffs, and in which, in the order given, lie the villages of Mwini-Wungu, Mpimbwe, Songesi, Puani, Chimaraunga, Nkamba, and Ntiwri. Roughly, there is one village for every 8 or 9 miles, and on all this length there is in winter no running stream. There were, however, numerous dry stream courses, in which a little bad water could be obtained by digging. The largest of these, the Chikamba at Mwini-Wungu's, had a width of 60 feet of sandy bed cut deep in the plain; it comes from behind Mount Ilomo, and during the summer carries a great deal of water to the lake.*

The village of Ntiwiri was the furthest point I reached to the north-east, and was the first recognized crossing of the plain, for, though at Mpimbwe and Nkamba it was said to be fordable, it was acknowledged to be difficult on account of water at Mpimbwe and for want of it at Nkamba. On account of wind, heat, and dust, it was the custom to cross from Ntiwiri at night or very early in the morning; so, as I had decided to cross, I started by moonlight at 4 a.m., with two men from the village to show me the way. Five miles out in the plain the grass ended, and gave place to bare, level, and smooth ground—the dried-up bed of Rukwa. Level as the water of the lake itself, this plain stretched before us to far beyond where we could see, and high above it in the clear morning air, just after dawn, the faintest outline of the far-distant hills was just discernible. Across this bare plain I walked in the fresh cool air of the still morning, and my people gamboled and danced in spite of their loads, until soon after sunrise the customary wind blew from the south-east and dried up their ardour in clouds of dust. Why over one hundred men should have capered and danced on the smooth bare ground, I don't pretend to explain; perhaps it was because they were turning homewards. These people break out sometimes that way, and this was not the only case I had seen when, in such a place, neither, heavy loads nor a long tramp in prospect could prevent them from spreading out over miles of ground, shouting, singing, running, and dancing like a pack of school children, and many of them very intelligently playing the fool.

It was a six hours' walk, or 20 statute miles, from Ntiwiri to Uchiya, a village on the opposite side of the plain, in the edge of the bush, which there lies between the lake-bed and the mountains. At Uchiya I was again on the same side of Rukwa as when I had first entered it down the river Saisi, and about 10 miles from the mountains over which, 80 miles to the south-east, that river tumbles to the plain. For the sake of rating the watches and closing my longitudes, I decided to go down again to where I had left the Saisi, and then to return and explore further north up the rivers Kafu and Ilunga, which the natives told me flowed into Rukwa only a few miles north of where I crossed; at the crossing there was no sign of them, only the dead and dry plain, without a sign of depression anywhere in it.

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* There is also, near Mpimbwe, a large bubbling spring of very salt water; it is in a deep pool about 12 to 14 feet in diameter, and is called by the natives Chitwatwa, a name copied evidently from the noise the spring makes.

The mountains which bound the plain on this side form the edge of the Tanganyika plateau (the Chingamba already mentioned); they run nearly parallel to the hills described as closing in Rukwa on the north-east, and like them they rise abruptly from the plain, but to the much greater height of 3000 feet or more above it, with the bare rock peaks of Memia, Kusa, and Nkukwe close on 1000 feet higher still. At the foot of the mountains is a fringe of bush, about 8 miles wide at Uchiya; but 35 miles to the south-east, at the town of Sakaliro, it narrows to less than a mile, and thence, on ground a little higher than the rest of the plain, it rapidly spreads eastwards from the hills till it reaches the open water of Rukwa at Senga, where I completed my circuit of the lake. Below this bush is the open grass plain, which extends in width for more than 20 miles to where I had walked up it, under the hills which bound it on its opposite side. Many streams fall in cascades from the mountains; but, except one (the Mba at Sakaliro), all are dried up before they get out of the bush, and this one reaches but a little way into the open.

On my way round the plain, I had, from Senga to Chiubi, travelled round the south-east end of Rukwa, keeping fairly close to the open water, and had been able to map its outline with some degree of accuracy. All the way round I had boys with me who knew the country, and at Songwe, Chipindi, and Njira I had spent some time in the hills overlooking the lake, and was able to get bearings over the water; but the haze was always thick, and I could seldom more than faintly make out the far side. Hearing at Chiubi that there was no more lake further to the north-west, I went into the hills there very early in the morning to see if, with a clearer air and rising sun behind me, I could distinguish more of the shore. I could easily see then that open water ended there, and there was an unbroken line of shore extending from Chiubi round the north to Senga; but though open water ended, a swamp extended to the north-west far up the plain. It was when looking over the lake there that I was told that three years before there had been considerably less water than now, and my informant pointed out below us where he had then crossed the lake from Chiubi to Senga on foot—an impossibility almost at present, he said, on account of deep water and high jungle. It is true that his assertion about crossing there was quickly denied by some of the others, but as my own men, who knew nothing whatever about the lake, were as vehement as the rest in denying it, I felt sure that their opinions were considerably influenced by their fears that I might try to take them across at the same place, and I believed the stranger.

About 25 miles to the north-west of Chiubi, at Mpimbwe I went again to the hills, and could see that the swamp from Chiubi continued this far, lying on the near side of the vast grassy plain, which spread out below me many miles to the horizon. From the men I gathered that the plain could be crossed in the winter here, but the water in the swamp was up to the knees.

Besides shooting over the plain at Puani, about 15 miles beyond Mpimbwe, I walked out over it to the swamp, the edge of which is at this place 2 miles from the hills. On the dry ground between the grass was short and not generally weedy, though there were remnants of high weeds which had flourished during the rains. The ground changed but gradually to very shallow swamp, growing short round rushes, and half a mile out in it the water was still only up to one's ankles, and the same short rushes continued without a higher weed to break the horizon. Here the natives told me that the swamp did not extend further, and from Nkamba, 8 miles more to the north-west, they said the plain could be crossed in winter on dry ground the whole way.

One man, who seemed to know most about the lake, said that there were two parts of it—one called Chela, which was the water round which I had travelled from Senga to Chiubi, and the other called Chisi. This second part of Rukwa (Chisi) is the part I crossed on the dry mud bed between Ntiwiri and Uchiya. About halfway across this I noticed some game in grass about 3 miles to the north, and a grass fire perhaps 2 miles further, so that this dried-up bed of the lake ends but little north of the crossing. I walked back next day a few miles along the edge of the grass, and the bearings I took agree with this supposition. I could not be sure how far it extends southwards towards the swamp and open water; at 10 miles south-east from Uchiya it was still close to the bush, but after that it soon disappeared in the plain, and from the hillsides grass only could be seen to the horizon, so that it either ended there or continued only as a narrow strip on the south side of the swamp, reaching in that case probably to the open water north of Senga.

It was in August when I was on the lake, and as there were still three months of the dry season to run, the water would probably fall lower than it was then. The line of rubbish washed up on the beach between Chipindi and Chiubi showed that it rose in summer from 4 to

5 feet higher. This agreed with the impression I had formed when standing on the bank of the opposite shore, that the water rises to this bank, but does not flood the plain beyond. From all I could learn at Uchiya, it rises in the summer from 3 to 4 feet at most on the dry bed of the lake, and less on the grass. That part of the plain in bush, from Sakaliro southwards, is higher than the rest, and though water may lie on it in pools during the rains, it is not water from the lake. Lake Rukwa is therefore in winter but a small piece of shallow water, situated at the eastern extremity of a remarkable grass plain, fringed with bush, and enclosed, at least for a length of considerably over 100 miles, between two nearly parallel walls of mountains running north-west and south-east, and from 25 to 35 miles apart. To the south-east of the lake, the plain rapidly rises and ends in the hills between Rukwa and Nyasa. A bare bed of the lake lies in the grass to the north-west, and is connected with the open water by 35 miles of swamp. Beyond this the grassy plain rises gently up the river Kafu; but, unfortunately, on my return to Uchiya, I was too ill to walk, and had to be carried back to the plateau, so that I could not explore, as I had intended, up this river to see how much further than I had already been it still extended to the north-west.

Rukwa is the name generally used on the plateau, and I think it applies to the whole of the plain. At the lake itself, "Hikwa" was almost invariably employed, and I think referred to the open water and flooded portion only. I also heard the names Lukua and Lukuga used. It receives the river Saisi on the west, the Songwe on the south, and the Kafu and Ilunga on the north, besides many other small streams which only carry water to it during the rains. It has no outlet, and lies at the same level above the sea as Tanganyika. In winter the open water covers an area of about 25 geographical miles in length by 10 in breadth, but during the rains it extends its length some 55 miles to the north-west over the dry bed, and forms a lake 80 geographical miles by 16, with a depth up to 4 feet over the newly flooded portion.

It is difficult to recognize, from the descriptions of Dr. Cross and Sir Harry Johnston, the lake as I saw it, and I think the reason must be that there was much less water when they were there. My camp on the Songwe river, at the south-east corner, was about a mile south-west of the village, now abandoned, of Mwini Wungu, where Dr. Cross had stayed a week. He went from there to Chipindi, a distance of 12 miles, for the last two of which the path is now on the lake-shore, and close under the hills. He does not, however, mention this, and Sir Harry Johnston, in his report of 1894, says it was doubtful if Dr. Cross had reached the open water. They both noticed an inlet on the south-east which Johnston calls "a remarkable bay or inlet winding into the mountains." "Winding into the mountains" is perhaps more than the writer meant; but with the water at a much lower level, it is quite conceivable that the capes on the south would extend further into the lake, and the bays therefore be much more pronounced than when I surveyed them; there would then be room, also, for swamp between the water and the hills where Dr. Cross walked to Chipindi. Nowhere else to the south and east, where the hills are, is there room for a deep bay, and no possibility of an "inlet winding into the mountains."

On the south-west side of Rukwa plain, under the high hills, where water is good, the country is somewhat thickly populated; the people there, from Uchiya nearly down to the Saisi river, being Afipa under two independent chiefs, Kapufi and Yulmase, those under Yulmase calling themselves also the Asukuma. On the Saisi and to the south-east are the Awanda, also divided under two chiefs, Kasonso and Kapala. Then come the Aungu under Mwini-Wungu, scattered less thickly round the south of the lake to Mount Ilomo on the east; and after these, in still more thinly populated and poorer country, each village seems to be a separate tribe, under the names Apimbwe, Asongesi, Alegelo or Alelo, Akamba, and Batiwiri. Small as these tribes seemed to be, the people paid their chiefs great respect; in two cases (at Nkamba and at Ntiwiri) the chiefs were women, named respectively Njelu and Chilasa, though they were spoken of only as Mwene-Kamba and Mwene-Ntiwiri, a custom observed all this side of Rukwa since Mwini-Wungu's. (Mwene = chief, and -Kamba, -tiwiri, and -ungu = the name of the tribes. On the other side, such terms as Mwene-Kasonso or Mwene-Kapala were used, but Kasonso and Kapala are the names of the chiefs themselves.)

Amongst the Awanda also I had seen women acting as chiefs of villages under the paramount chief Kasonso, whose daughters they were said to be, and in all cases they were treated with respect and some ceremony by their people, and were generally accompanied by from ten to fifteen headmen, amongst whom I supposed was the husband; but as he was never pointed out to me nor referred to in any way, I presume that amongst these tribes the husband of a chieftainess may be a man of little or no account. Mwene-Kamba was the most important of these women chiefs, and settled near her is a somewhat remarkable man named Chimaraunga, who has no country of his own, but takes what he wants from the others.

The son of some distant chief, he took to hunting, he told me, on Rukwa, and killed many elephants there. Naturally many people gathered around him for the sake of the meat, and then remained as his followers; in this way he became strong amongst weak tribes, from which he could still further recruit for his own following every man with a grievance and every bad character. As his followers increased and elephants became scarce, raiding his neighbours took the place of hunting, and from successful raiding to dominating the country was not a long step. At the height of his power he built the strongly entrenched village of Sakaliro, in the most populous part of Rukwa, and thence raided amongst all the tribes round him, eastward amongst the Aungu, and northward through the Afipa to the Amambwe, almost meeting the Babemba, who from the south-west were raiding this same tribe. The ruins of large villages strewn with skulls, and 30 miles of road which he had forced the natives to cut and keep clean from Sakaliro to the river Saisi, were pointed out as Chimaraunga's work. In 1894, having become the scourge of the country, he was attacked and defeated by the Germans, and driven from Sakaliro; he then crossed Rukwa, and as he was not followed up he settled amongst the Akamba, and has built his new village, in spite of her protest, alongside that of Mwene-Kamba, and where she has an outlying village he also has built another. He is much too strong for her to drive away, but he is too much afraid of the German Government to openly fight her and take her country, so they live in a sort of armed peace, Chimaraunga, however, having much the best position. On my journey I had to pass his village to get to hers, and I should in all probability have gone to see him, but this was not at all Mwene-Kamba's idea. She was the chief of the country, and on her I must call first, and in her village I must stay. Miles before I got to the village, I saw her with a dozen headmen and thirty or forty villagers coming to meet me, and I was led by her in triumph close past Chimaraunga's town to hers, in which her own enclosure, newly swept, was set aside for me, and the German flag hoisted in my honour.

It was a small triumph to her that Chimaraunga had to come to her village to visit me, and under the protection of a white man, and perhaps a little under the influence of the beer which she had lavishly given out to welcome me, she could not help showing that she enjoyed her triumph, nor refrain from angrily giving her enemy a piece of her mind in the presence of the crowds of their followers, who with my men had assembled to watch the interview. Apparently trying to calm her anger, Chimaraunga said he was getting old and only wanted to settle in peace; but the angry chieftainess refused to be pacified, and wanted to know on whose land he could settle, having none of his own; nor was she satisfied by his acknowledgment that the land was hers, nor by his assertion that he only wished to settle until he could collect enough food to enable him to leave the country quietly with all his people. Judging from his history and the manner of his people, this statement did not seem, even to me, very credible, and Mwene-Kamba asserts that it is only one of his ways of lying, and that, unless the white man comes soon and takes him away, she will be murdered in her village, and her country will become his. She knows their ways and may be right, but he has a wholesome fear of the German power, and is likely to be cautious. Every village has some complaint against him, and when I told them I was not a German and could not interfere in their affairs, they all seemed truly disappointed, except perhaps Chimaraunga, and I think he was glad. He brought me presents of a goat and much flour and beer, and later, when I was ill, nothing would persuade my people that he had not used medicine or bewitched the goat in order to kill me. It was useless to point out that they had eaten most of the goat and all the flour, and had got drunk on the beer. The medicine, they said, was only intended for me—I was ill, and that proved it. Though he has been defeated since 1894, the people have by no means lost their fear of him, and all down the Fipa side of the plain, when we came suddenly on them, they bolted at sight of us, and the women especially disappeared like rabbits in the bush. A call from some of my men who were known soon brought them back, when they laughed good temperedly and invariably explained that they had thought I was Chimaraunga.

Except the growing of food, the only industry of the people round Rukwa is the making of cloth. In most villages, and especially in those of the Afipa and Awanda, a large portion of the men are engaged in this work, either spinning the cotton or weaving the cloth. The cotton is from the seed-pods of a weedy-looking shrub, which, like the castor-oil plant and hemp, is planted when their gardens are started, and then left to take care of itself. The men do all the spinning and weaving, using a long spindled spool, and giving it the necessary twirl by a smart rub of the spindle between the palm of the hand and the thigh. The loom is a rough frame so arranged that the alternate threads can be raised or lowered past the rest, and cross-threads are then passed through on a long wooden lath. The cloth is open and heavy, but strong and much more durable than the cheap calico and coloured prints which are rapidly taking its place. The commonest patterns are white with black striped borders, though checks and black cloths are seen. It is generally made in pieces of about 6 feet by 5, each cloth being sufficient for a dress. All the men and women round Rukwa wear them, but I think there are few now exported, for just to the south on the plateau European calicoes are worn, and a little further south, the Babemba are dressed in bark cloth. A portion is traded to the Afipa on the plateau for iron hoes, and a small quantity even now gets as far as the Mweru marsh for the purchase of salt.

Food was very plentiful the whole way round, and in presents alone I got almost enough to feed my caravan of over one hundred men. It consisted principally of flour, beans, pumpkins, and maize, and mostly a few fowls and a goat were given to me at each village. Cattle I only saw twice—the first were a few at Mwini-wungu's, and at Uchiya there were three, belonging to the chief Kapufi on the plateau above, but sent down there to be attended to. Fishing was carried on to a small extent, and altogether there were six small canoes on the lake used for this purpose. They were only built for one man each, and were small even for one, the opening on the top being but a slit of a few inches wide, giving hardly room for one's foot to enter. They were propelled entirely by poling.

Johnston thought Rukwa unlovely and uninhabitable, possessed of seven devils—hunger, thirst, a scorching and skinning wind, thorns, a blazing sun, venomous flies, and wicked and sullen men, though he acknowledged that, after all, they did not receive him badly. It had not rained when he was there for two years, and the people had been harassed by slavery for a long time. Under such circumstances, there are few parts of Africa, I imagine, that would be either lovely or pleasant to live in. I found the people very friendly, and I hardly ever arrived at any village without being met and escorted to it, for the last half-mile or more, by the chief and some of his or her headmen. A portion of the chief's enclosure was set aside for me, and huts found for my carriers, and beyond a visit or two of ceremony from the chief, with presents of food, and other visits, perhaps, from the headmen of villages near, I was left fairly quiet and not pestered by the crowd of curious men and women who, in most villages, press round and criticize or mimic one's every action. The villages, it is true, were generally dirty and dilapidated, and compared very unfavourably with those in the higher country.

The politeness of the people to one another was very noticeable. Their salutation on meeting was a low curtsey and a light clapping of the hands, with a set formula of phrases, which in itself seemed almost a conversation. To a white man, however, here, as in almost all of Central Africa, the salute is simply the English "Good morning," or as near an approach to those two words as an African can manage.

After leaving Rukwa, where I found no elephants, and after spending a month to recover at Abercorn, I went to the Mweru marsh, where I had shot with some success the year before, and hoped there to retrieve my bad luck before the season was finished. This marsh is not so interesting, and was better known than Rukwa; it is situated 40 miles to the east of Lake Mweru, and was described in a short paper read by Mr. Alfred Sharpe, but it had never been mapped before my visit. Mr. Croad also contributed a short paper, which was accompanied by a small sketch of it. This sketch, however, was a little in error, as I had not completed the working out of my observations when I gave it to him.

Mweru marsh is a large and generally swampy plain, 3000 feet above the sea, about 35 geographical miles in length from north to south, with a breadth varying from 10 to 15 miles; two narrow arms extend up the Mawe and Chisera rivers on the north, and one down the Mofwe on the south. It is bounded by steep hills on the east, and on the west by hills which rise less abruptly from it, but are equally well defined.

It cannot be described as a lake, and in the driest season only part of it is marsh. It was in September, 1896, that I went there first, but before actually entering the swamp I journeyed all round it, as it was then said to be too early to go in; the water was still deep, and the grass had not been burnt. All down the western side low bushy hills rise gently out of the plain, which here was firm ground covered with short grass near its edge, but with beds of high weeds a mile or more further out. It showed signs of being swampy in places during the rains, but not of open water lying anywhere. At one place on this side, well up in the grass, was the wreck of a canoe, which must have been stranded there at a time not far distant, for the wood was not much injured by fire nor touched by white ants. Tracks of elephants and rhinoceros were plentiful, and once while resting in the heat of noon, the men all lying about on their loads, a bull elephant strolled up from the weeds, and, standing lazily flapping his ears in the plain within a short distance of us, seemed irresolute as to where he should go, until we decided for him.

All down this side, except on the Choma and Mkubwe rivers, water was scarce, and generally, except at the rivers, all round the swamp it was only obtained from small holes dug about 2 or 3 feet in the ground, well above the marsh, but not in it. Into these holes trickles a running silt as thick as gruel, which settles and leaves 1 to 3 inches of water on top. This is patiently dipped off by the natives. We tried in places to get more by digging deeper, but the silt only ran from one very thin stratum, and the holes filled up to the level of this, leaving, as before, a few inches of water on the surface. This water is, when constantly dipped and not allowed to stagnate, cool and fresh, but tastes of mud, and is of a greyish colour. It seems quite wholesome, and is preferable to that from the rivers running into the marsh, which is often high-smelling, especially after the first rains, when it positively stinks.

On the south-east the hills in places rise precipitously from the plain some 800 feet or more, but soon turn away to the east, and others not so high, but also with a steep slope to the swamp, close it in all up the eastern side. Close under the highest hills are many hot springs, of a temperature of 115° Fahr., and near these are some patches of open water formed by the rivers Mkubwe and Mwambezi, which flow in from the heights above. The plain to the south is generally a swampy jungle, but further north, on the east side, it soon changes to a level expanse of bare mud, which extends from the foot of the hills to as far out as one could see. Water lies on this perhaps a foot or more deep in the summer, but we only found a dried and cracked crust all over it, so that walking on it was like walking on loose tiles. Here and there was a narrow channel of stagnant purple and intensely salt water, and near the edges of these channels, where one of us happened to break through the crust, he sank to the knees in sticky and stinking mud. This mud was not, however, very deep, for there were tracks where elephant had crossed it even before the crust was quite dry. The mud plain, and the swamp south of it, are known by the natives as Mweru Wantipa, or the lake of mud. We found no drinking-water at all up the east side, and had to sleep one night there without it. Starting long before dawn next day, I arrived at 10 a.m. at a village in the north-west corner, the chief of which sent back about fifty women and boys with water to bring in the rest of my men, who straggled in, in twos and threes, between one and two o'clock. From this village again there was no water until we crossed to the river Choma, 20 miles further across the north of the plain.

The Mweru marsh receives the rivers Mkubwe and Mwambezi on the south, and Choma and Chisera on the north, the first three running all the year, and the last only during the summer. The Mawe is little more than a waterway, which drains that arm of the swamp in which it lies and takes some of the flood-water from the Choma; it then connects the Choma and Chisera rivers. Besides these rivers, the hot springs on the south-east carry in between them perhaps as much water as the Mkubwe and Mwambezi rivers during winter. This hot water is clear, odourless, and tasteless; at one time we cooked with it and drank it freely. The outlet is down the Mofwe plain to the river Kalongwisi and Lake Mweru.

Near the rivers and open water hippopotami abound, and during the winter elephants are plentiful all over the plain; sometimes two or three large herds may be seen in a day, leisurely strolling through the low jungle, dusting themselves with roots of grass, and generally accompanied by flocks of white birds, which hover around and settle thickly on them. I may mention, for the benefit of any one who might think of going out to shoot on the swamp, that it has since I was there been proclaimed a preserve by the order of the British South Africa Company. All the rivers carry fresh water to the marsh, but in places where it has lain in shallow pools and been dried up it leaves a thin crust of salt on the surface of the soil. The crust is collected by the inhabitants, packed into funnel-shaped baskets, and water filtered through it into troughs below. The water is then evaporated for the salt it has absorbed, and the salt supplies the country for over 100 miles around. Salt is the trade of the marsh, and all the villages on the west side are engaged in it. Men make journeys from long distances to buy it, and probably from 15,000 to 20,000 lbs. weight is thus exported per annum.

The people around the marsh are Atawa, a tribe united, when Livingstone was there in 1867, under one chief, Nsama, but now broken up by Arab and Babemba oppression into many divisions, some of them still under members of the Nasama family, but not one strong enough to take the lead of the rest. Nor will the chance for this be likely to arise now that the British have occupied the country.

Before arriving at the Mweru marsh, I had always been under the impression that it was an impenetrable swamp full of elephants, which, on account of the water and thick reeds, were quite unapproachable. During the time I was there, certainly the greatest difficulty was the scarcity, not the abundance, of water. Besides going round it, I shot over a great portion of the northern half of it, and it was quite necessary to know where the water was, or I might often have had to camp a night without it. It has not, however, always been so dry. The chief, Lualika, who lived on a little hill called Chipiri in the marsh, at the time of the Arab raids, says that they used then to go to and from the mainland in canoes, and it was probably one of his canoes which I had seen high and dry on the grass not far from Chipiri. I was on Chipiri some time, and almost all round it then the ground was quite dry, but swampy during rains. When Dr. Livingstone crossed the Chisera in September, 1867, near the end of the dry season, he found it more than a mile wide, and difficult to ford. This was not far from Mkula's present village on the Chisera, where the plain is wide. I crossed it in many places a little further down the river without a sign of water, except at one spot where there was a little swamp with hippopotami in it; whenever I crossed it by Mkula's village, the river Chisera was quite dry.

It is the drying of places like this great marsh which often gives rise to the statement that Africa itself is drying up. Certainly the Mweru marsh has carried much more water than when I saw it, and on the high plateau one often sees well washed-out watercourses which now carry little or no water. The level of the water in Tanganyika, too, is much lower than it was some years ago; and on the river Shire, steamers that used to go constantly to near the Murchison falls cannot now get even to the junction of this river with the Zambezi. The question is an important, indeed a vital, one for the future of Africa, and the little evidence I could collect on Tanganyika, Mweru, and Rukwa seemed to show that there is a fluctuation in the amount of rainfall more than that there is any constant diminution.

Taking the Mweru marsh, for instance; dry as it had become when I was there, its condition was considerably changed during the one rainy season after I left it. Dr. Watson, the collector and magistrate of the Mweru district, wrote me that, owing to the great rainfall, Mweru Wantipa, in the words of the natives, had returned. It was, in fact, in a condition it had not been in for years. The Choma came down very early in flood, and throughout the season carried a tremendous quantity of water, so that now there are horizons of open water to be seen on all sides, and springs that had been dry for years have come to life again. Another year like this and it would become an impenetrable swamp again, and a real refuge for elephants. Then the spongy soil of the marsh and of much of the country through which the rivers to it come, being well saturated, would retain the water for a long time, and the high rank vegetation would prevent much evaporation during the winter. With little rain, however, for some consecutive seasons after, and the ground in consequence drying, the vegetation could be burnt, as it has been every year lately, and the sun's full power would again bake the bared soil and once more exhaust all its springs. One year's heavy rain, therefore, seems to fill the Mweru marsh, and it probably dries only slowly for years, until another very wet season fills it once more.

Neither could I recognize any signs that Rukwa was sensibly drying up, and, as I have said already, a native guide assured me that there had been much less water in it but a few years ago. Heavy thorn-trees and thick bush grow now in places close up to the shore, in such a position that if the lake were but a little higher at least all the summer, these would be under water, and during their lifetime I think the lake has been at least no higher than now.

The level of Tanganyika has fallen much since 1887, when the little mission steamer *Good News* used to anchor where now there are gardens, and all round the lake there are signs of the water having been higher than now. In a sheltered bay near Tembwe head on the west side there are evidences of recent beaches, which I measured and found to be 16 feet above the present level of the lake. When Stanley was on the lake at Ujiji in 1876, it had risen considerably since 1871, when he was there before, and he says that palm trees which had stood in the market-place in 1871, were in 1876 100 feet in the lake, and the sand beach over which Livingstone and he had taken their morning walks was over 200 feet in the lake. Since 1890, at Kituta, on the south, no difference has been noticed in the level of the water, except that it may have gone down a foot or more, for what was in 1890 swamp is now dry land. This, however, may be the effect of drains which have been cut.

Some of the French Fathers of the Algerian Mission told me that the mouth of the Lukuga, the outlet from Tanganyika, has now a bar across it, and no water flows over it; but as the whole drainage area of the lake basin is five or six times that of the lake itself, and as the level of the water does not perceptibly change throughout the year, there must be some outlet that takes away the flood waters of the rainy season, and the level of the lake depends not only on the rainfall, but also on the amount of water that can get through or over the bar down the Lukuga. From this evidence it appears that the water rose in Tanganyika from 1871 to between 1876 and 1886, and fell till 1890, since which time it has been stationary. Rukwa was low in 1889, and perhaps till 1894, but has risen since. The Mweru marsh was full in 1867. What variations it went through till 1894 are unknown; from then to 1897 it was drying up rapidly, but in 1898 it filled once more. In none of these cases is there real evidence of steadily diminishing rainfall, and I saw nothing to lead me to suppose that, within any reasonable time, either Lake Rukwa or the Mweru swamp has been considerably larger than it is now, or was quite recently.

The slow filling up of Rukwa by the mud brought down by the rivers in flood, and the consequent diminishing depth, are quite another question. Diminishing depth means an increasing amount of evaporation, and this with the same amount of rainfall each year can have but one end where the proportion of plain is great compared to the area that drains to it, and ultimately Rukwa must become dry, or at best be but a swamp, during the last months of every winter, and perhaps even with a somewhat greater rainfall this end would only be postponed.

No measurements of rainfall have been taken on the lowlying ground like Rukwa and the Mweru swamp, but at Abercorn, on the plateau above, it is about 35 inches per annum, the whole of which falls between November and April. There is mostly a dry time of two or three weeks in December, and, though it may rain almost every day after until April, still the rain is not incessant, and almost every day also there are a few hours of bright sunshine. The temperature throughout the year does not vary much, for the clouds and rain cool the air in the summer. My observations at Abercorn showed that during the whole year the maximum thermometer varied only between 76° and 86° Fahr., and the minimum between 45° and 58°. The observations were a little fragmentary, but I think they are not far from the truth. In swamps on the high plateau I have seen frost in the early morning, but I have never known the thermometer at Abercorn to register a temperature below 45°.

Situated on the direct line of the projected railway from the Cape, and with other natural outlets down the Shire and Zambezi, this plateau contains from 25,000 to 30,000 square miles of country over 4000 feet above the sea, and of this perhaps 10,000 miles have an altitude ranging from 5000 to 7000 feet. The climate is dry and subject to no great fluctuations of temperature. Malaria unfortunately exists, but it is not virulent, and Europeans living on the high land look ruddy and well. Black-water fever, it is true, has carried off a large proportion of the few white inhabitants, but the study of tropical diseases, which is now being carried on, will soon, it is to be hoped, lead to such knowledge that even this fever will have no terrors for those who have to risk its attacks, and then the Tanganyika plateau cannot fail to become of value to England, not only as a residence for the few traders who may receive the products from the low tropical country round, but also as a not unpleasant place possibly suitable for colonization, and capable of being made rich by the cultivation of such valuable substances as indiarubber, which are now only traded in small quantities from the natives, who with their natural improvidence never hesitate to entirely destroy all the rubber vines within reach for the sake of the rubber of one year.

There are not yet sufficient indications to show what other products may ultimately be exported, and we can form no opinion from experience of other countries, for the conditions of this country are unique, and nowhere else, except in the cordilleras of South America, is there any such high plateau so near the Equator. I travelled for some time over the Bolivian plateau, which is from 13,000 to 16,000 feet above the sea, and in places is deservedly known as "el despoblado," and what impressed me most was that, from the want of water or from the severity of the cold, it was in a great part a desert and uninhabitable, and but for its mines of silver and other precious metals would probably only be inhabited by Indians. The conditions of the Tanganyika plateau are quite different; not being at such a great altitude, its climate is much milder, and it is altogether better watered and more thickly populated. No precious minerals have been found, and there is as yet no native industry; the whole of the cloth and beads, etc., at present imported are almost entirely used up in payment for the labour and food needed by the Government and mission stations, and for the transport of their goods over the plateau, and of those goods which the German Government or the Congo Free State may import by this route.

The country is covered with thin bush, with open glades of no great extent. The soil is not generally rich, but everywhere there is some good land where wheat and all English vegetables and tropical fruits can be grown abundantly; more than enough wheat for use on the plateau is grown by the L.M. Society, and potatoes and vegetables of all sorts with the least care are equal to any in Europe. Cattle thrive well, but there are few now, as they were killed off by the rinderpest or taken for food by the Awemba, who, having been accustomed to steal so much of what they needed, are now even more improvident than their neighbours.

However suited the country may become for Europeans, its value will naturally depend on the industry and friendliness of the native inhabitants. At present they may be said to be generally friendly to the English, and even the Babemba are not actively hostile; but it must be remembered that as yet there has been no attempt made to impose much rule on them, and they have not been asked to pay any taxes. It was fear of the Babemba which first made the other tribes welcome the English, but the Babemba are rapidly breaking up, and at the same time the weaker tribes are gaining confidence in themselves, or at least losing their fear of their old enemies. When that fear has disappeared, they will not feel so content under English control, and at least a show of force will be necessary before they can be made to pay any contribution in taxes towards the expenses of administration. Such taxes as yet, whilst there is no money in circulation in the country, could only be paid in labour or in kind, and, if imposed before Lobemba is properly occupied, would cause too much discontent and friction to be worth collection; it is also certain that many people would move out of English territory across the German border. Just lately, when asked for labour to deliver the telegraph material along the road from Nyasa to Tanganyika, some difficulties were made about supplying it, though it would have been paid for at rather a high rate, and two chiefs closed their villages against the magistrate, and made at least a show of armed resistance.

Such, then, are the people now; not unfriendly to, and somewhat afraid of, the white man, but always inclined to resist as far as they can his assumption of authority over them. They by no means consider themselves a conquered people, and as African natives they are not accustomed to be obedient for love, or to pay taxes from any sense of duty.

Before the reading of Captain Boileau's and Mr. Wallace's papers, the PRESIDENT said: This evening we have two papers relating to the same country, the Tanganyika plateau, one by Mr. Wallace, who has passed some considerable time there in search of sport, and the other by Captain Boileau, who served with the delimitation commission, to decide the boundary between Germany and England on the plateau. Captain Boileau, I think he would wish me to say, served under his senior officer, Captain Close, and he tells me that he received orders to write this paper from his superior officer, and I am sure you will find, when you have heard it, that he has carried these orders out in a most admirable way.

After the reading of the two papers, Colonel Sir T. H. HOLDICH said: I have listened with much interest to Captain Boileau's capital paper, and regret that my limited acquaintance with the African continent does not permit of adding anything to the local information which he has given us in so pleasant a manner. My African experiences began and ended with the survey of the Abyssinian watershed, which looks down on some of the chief sources of affluents of the Nile on one side, and on the drainage to the Red Sea on the other; and when I recollect the hot, damp, steamy atmosphere of the Red Sea shore in June, and the painful watching of stars by night to determine the longitude, I can only congratulate Captain Boileau on his happier experiences.

And it is his survey experiences and the few technical remarks that he has added to his paper which naturally interest me most. If he had purposely adopted the methods developed by the old Afghan Boundary Commission of 1884, and some other later survey efforts in the Asiatic wilderness, he could not have been more successful in running his surveys on the same lines. Even to the difficulties of getting a clear line for his telegraphic operations there is a curious analogy of experience. One persistent and obstinate cause of discomfiture was at least spared him. There were no stray camels to run against the telegraph wire or rub themselves against the telegraph posts until they came down. And yet another special difficulty, I remember, arose, when our colleague at the other end of the wire announced that he had married a wife, and therefore was not going to get up to gaze at stars any more.

There is, however, one very important aspect of Captain Boileau's work to which I would call your attention. It is the fact that with the advantages of the telegraph and the use of small but accurate survey instruments large areas of country can be rapidly surveyed, and that they can be made to fit exactly into their right place on the world's map, dovetailing with geographical exactness into the edges of other scientific work on every side of them without the aid of that costly process of geodetic triangulation which has hitherto been necessary to preserve continuity and exactness in position. Not by any means would I depreciate the value of geodetic work. It must all come sooner or later, and the magnificent geodetic series already run by Gill, Morris, Grant, and others in Southern Africa is but a foretaste, I hope, of what may successfully be carried out right through the continent. But its scientific end and aim comprises a good deal else than the furnishing of a basis for geographical mapping, and it is clear that new methods and new instruments can assist us to the latter end, without fear of disagreement or argument when it comes to boundary settlements without this geodetic basis. There is an immense amount of this sort of work before us in Africa, which is but a patchwork of nationalities, and it behoves every officer engaged thereon to remember what may come after him, as well as what he has in hand. Therefore it is most satisfactory to hear of careful and accurate observations being taken to distant peaks and landmarks that may serve most useful purposes to future surveyors. Nor is it with anything but the keenest pleasure that I recognize the name of one of my old survey assistants, Wahid Ali Khan, as a useful topographer. But with his name there opens up a question most important to the interests of African geography. I would ask whether, if Indian surveyors—not always of the very first class—are found so useful as African topographers, it is not time to start a school of African surveyors? I cannot enter into the question of how or when it should be done. That must wait for another time. But I am sure that Captain Boileau will agree with me that the more good native topographers you can get in Africa, the better for all concerned.

The President: We have had this evening two very interesting papers, for which we have to thank the writers, on nearly the same country, Captain Boileau's describing the country between Nyasa and Tanganyika, and Mr. Wallace, going somewhat further afield, gave us for the first time an interesting account of Lake Rukwa. Captain Boileau wishes me to explain to the meeting that he was, during the whole time of his survey, serving under Captain Close, who was the leader in conjunction with the German party. His paper, I think, was admirably arranged, and gave us an exceedingly clear idea of the physical aspects of the plateau, and he also gave us a very interesting account of the people and the missions. His surveying work and Captain Close's have been commented on by Sir Thomas Holdich, and I think, when I have some months hence to report at Berlin what we have done with regard to General Chapman's proposal for the triangulation of Africa, that, thanks to Captain Close and Captain Boileau and the astronomer at the Cape, and others, we shall be able to give a very satisfactory account of the progress that has been made during the last year. Mr. Wallace has described that very remarkable grassy plain, which he tells us is 100 miles in length and from 25 to 30 miles in breadth, bounded by straight lines of hills on one side, apparently precipitous; and I regret that his health did not permit him to complete the examination of that somewhat remarkable formation to the northward; but what he has done is very important. He has for the first time, as I have said, given a very complete and full account of a lake previously unvisited except by Sir Harry Johnston, who, I think, did not succeed in reaching the actual margin of it.

We, therefore, have now to pass a very cordial vote of thanks to Captain Boileau for his paper, and for the way in which he illustrated it, and to Mr. Wallace also for his most interesting communication. I am quite sure the meeting will pass these two votes by acclamation.

NOTE ON THE HEIGHTS OF LAKES NYASA AND TANGANYIKA ABOVE SEA-LEVEL.

By Captain C. F. CLOSE, R.E.

The following is a list of the previous determinations of the height of Tanganyika, as shown on the maps in the map-room of the Royal Geographical Society :—

	Feet.
Baumann	2886
Stanley	2755
Hore	2749
Cameron	2709
Stairs	2690
Wissmann	2670
Popelin	2663
Reichard	2558
Mean	2713 feet ± 23 feet.

The following is a list of the determinations of the height of Nyasa :—

	Feet.
Kirk	1522
Stewart	1623
British party, Anglo-German Commission, 1898, A.,* Chinde and Fort Johnston	1583
” ” ” ” ” A., ” ”	1633
” ” ” ” ” A., ” Karonga ...	1646
” ” ” ” ” H., ” ” ...	1900
” ” ” ” ” H., normal ” ...	1650
Mean	1651 ± 30

The difference by barometric determinations of the levels of the two lakes is thus 1062 feet ± 38 feet. Now, the difference of these levels by the triangulation carried out by the British party of the Anglo-German Commission, was found to be 935 feet ± 22. The weighted mean is therefore 980 feet, which may be taken as the probable difference of level of the lakes. Whence the errors in the heights of Nyasa and Tanganyika are respectively 46 feet and 36 feet; and the height of Nyasa above the sea is 1700 feet, and of Tanganyika 2680 feet.

These will be modified if the results of the German party are published, but certainty will only be reached by levelling up from the sea. It is believed that the railway survey recently carried out by Mr. Tower will throw light on the question.

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* A. = aneroid.
H. = hypsometer.

ON KUMATOLOGY.*

(THE STUDY OF THE WAVES AND WAVE-STRUCTURES OF THE ATMOSPHERE, HYDROSPHERE, AND LITHOSPHERE.)

By **VAUGHAN CORNISH**, M.Sc. (Vict.), F.C.S., F.R.G.S., Associate of the Owens College.

THE following is an abstract of Mr. Vaughan Cornish's paper. The author proposes to treat the subjects here referred to in a detailed manner in a series of papers, which will appear as the different branches of the subject are successively ripe for treatment. The papers "On the Formation of Sand-dunes" (*Geographical Journal*, March, 1897) and "On Sea-beaches and Sandbanks" (*Geographical Journal*, May and June, 1898) may be regarded as Nos. I. and II. of the series. The present abstract, which introduces the new term "Kumatology," and gives a preliminary definition of its scope, may be regarded as the third of the series.

"The importance of the study of waves in geography has not yet been fully recognized, except in the case of tides and earthquakes. My purpose to-night is to bring before the Society the advantage of grouping together and studying together the waves and wave-structures of the atmosphere, hydrosphere, and lithosphere. Certain of the wave-phenomena I have already dealt with at afternoon technical meetings during the last two years, under the titles of 'Formation of Sand-dunes' and 'On Sea-beaches and Sandbanks.' I want to emphasize the significance of these studies. They are but parts of a whole, but it is difficult for any one not a specialist to realize this, because the parts have familiar names, whilst the whole has no name. I think the time has come when it will be for the advantage of our science that there should be a distinctive word for the study of the waves and wave-structures of the Earth as a special branch of geography. Κῦμα, genitive Κύματος, is Greek for 'a wave.' I propose that the word 'kumatology' be added to the vocabulary of our science, to designate that department of geography which deals with the waves and wave-structures of the Earth. Tides and earthquakes already receiving the whole attention of individual specialists, I do not further refer to them to-night, but describe the study of the kumatologist outside those subjects as being air-waves and wave-clouds, the waves of the sea, in themselves and in their actions, the waves of lakes and rivers, the sand-dunes of the coasts and desert, and the work of the wind in making and sifting sand and dust, sandbanks and sea-beaches, the sand-waves which corrugate the beds of streams and rivers, the ripple-mark of the sea-bottom and its homologous forms, the ripple-ridging of hillsides, and the waves of drifting snow.

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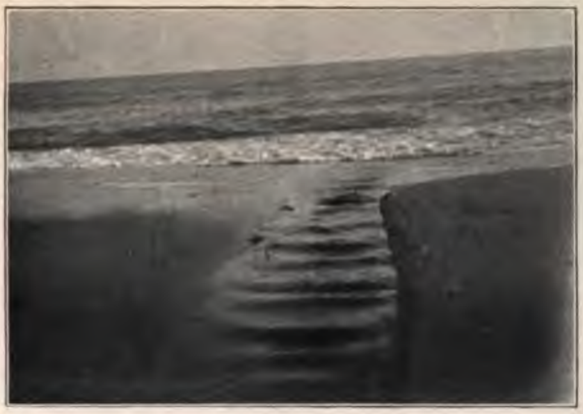
* Abstract of paper read at the Royal Geographical Society on March 27, 1899.

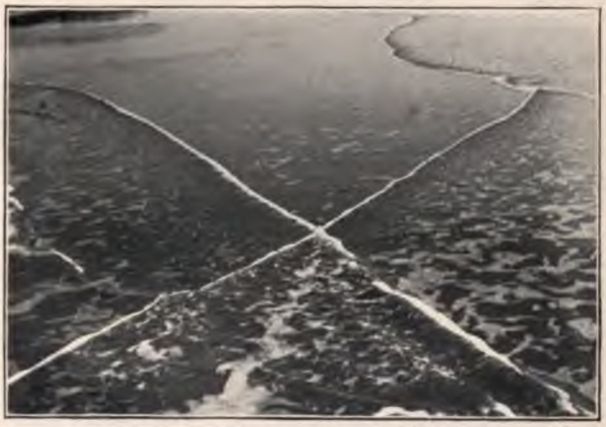
PLATE I.

A



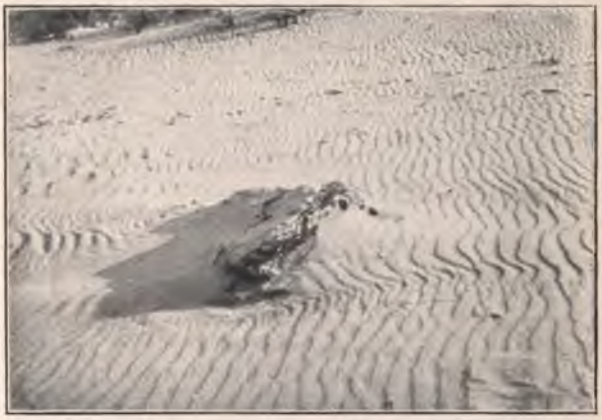
Water Waves, controlled by sub-aqueous sand waves travelling up stream.
From a photograph by the author.

B



Crossing Waves.
From a photograph by the author.

C



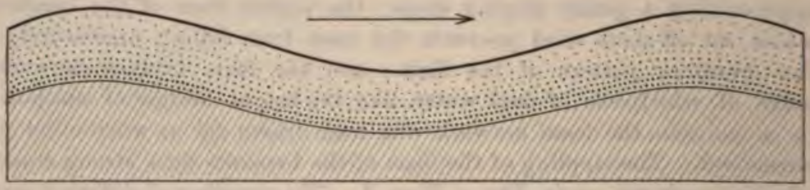
Dry Sand rippled by wind.
From a photograph by the author.

He will also study the erosion forms complementary to these accumulation forms, whether in rock, or snow, or compacted sand. And besides all this, there is the study of rock-folding from the special point of view of the mechanism of waves, which I think may yield great things. Further, the methods necessary for studying waves will, I hope, find incidental applications to other problems of physical geography, such as the forms and movement of glaciers.

"I propose to illustrate what I mean by kumatology by showing and commenting on photographic lantern-slides of some wave-structures."

Mr. Cornish then illustrated from the lantern slides the mounting up of a swell on entering shallow water, with steepening front and flattening of the back; the gradual diminution in size of waves in approaching a gently sloping shore; the perfect form of the breaker when an off-shore wind prevents the crest from falling prematurely; the network pattern of the foam; and the foam bridges between pairs of whirlpools of dark water, like the bright bridges of sunspots. In a cascade, the foam network was seen drawn out as when a net is stretched. The rippling of the foam of the breakers by a strong cross-wind was shown, as in Fig. A, Plate I. The crossing of different sets of waves, giving dark, sharp-pointed wedges, or flashing mirrors of light, according to the position of the sun, was shown; and the placid surface of a lake on a calm day was seen to be rising and falling in swells when illuminated by the slanting light of the setting sun, which brought out the low relief. In another photograph the apparently glassy surface of a pond was seen, by the systematic distortion of reflection, to be agitated by waves. The mutual independence of crossing waves was illustrated, as in Fig. B, Plate I. Then followed a series of photographs of the complicated train of waves which follows a ship in her course, each wave preserving its position relatively to the ship, but the rear of the group travelling only at half the speed of the ship, so that the train of waves is ever lengthening. Canal-boat waves and the tidal "bore" brought the lecturer to the waves of streams, and he described in detail some curious waves, of which photographs were shown, which travelled up-stream, not as a "bore," but without change of form (Fig. C, Plate I.). These he had observed in streams which plough their way through sandy beaches to the sea. The water-wave was really controlled by a submerged sand-wave, the up-stream flank of which was exposed to a heavy shower of sand from the turbid water (see diagram, p. 626). The stream being shallow and its surface in waves, the crest of the water-wave was pushed up-stream as the up-stream flank of the sand-wave received additions of material. The scour of the water was thereby deflected, and the lee slope of the sand-hill was scoured away just as fast as the weather slope grew. Thus the sand-hill moved up-stream, although every particle of sand

and every particle of water travelled down-stream. By the subsidence of water from temporary channels, "ripple-drift" sand-structures were sometimes perfectly preserved, as shown in Fig. A, Plate II. Mr. Cornish then showed photographs of ripple-marks mimicking organic forms, and of rippled clouds, and the ripple-ridging of hillsides, and went on to deal with the rippling of sand by wind (Fig. B, Plate II.). A table of measurements was exhibited, which proved that the shape of these ripples was approximately constant for wave-lengths from 1 to 145 inches. The shape was the same in desert sand as in the sand of the seashore to within 4 per cent. He had succeeded in reproducing these ripples by the action of a steady artificial blast upon ordinary heterogeneous sand, but artificially assorted sand containing no fine particles was not thrown into ripples. For this it was necessary that there should be particles fine enough to be tossed away by the eddy which forms in the lee of the larger grains. Sand-dunes were built up by the wind on similar principles. Photographs of desert sand-dunes were shown, one of which exhibited the recent encroachments of sand which have buried the road between Karachi and Clifton (Fig. C, Plate II.). The sand-dunes here are advancing as a train of waves before the south-west monsoon.



UP-STREAM WATER-WAVE AND SAND-WAVE. TRUE SCALE: WAVE-LENGTH 9 INCHES. (MEASURED BY THE AUTHOR.)

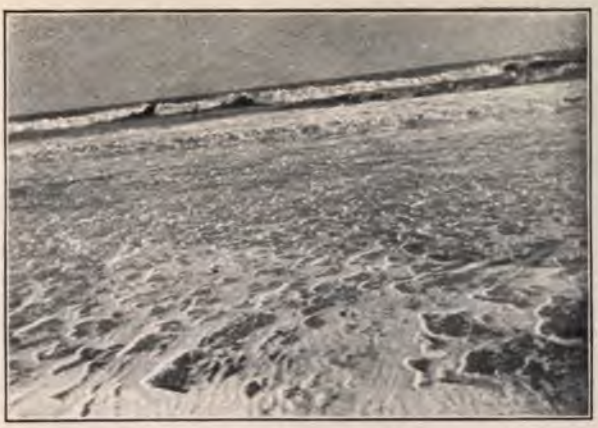
The slides shown, upwards of forty in number, were from part of the collection of photographs which Mr. Cornish has made during the past four years. The value of this collection is not merely for purposes of exposition and illustration, but also as evidence and record of the phenomena of kumatology, many of which are illusive and difficult to observe.

After the reading of the paper, the following discussion took place:—

Captain WILSON BARKER: I am afraid I am hardly prepared to make any remarks to-night. My own investigations have chiefly had to do with a comparison of wave-disturbance by the varying motions of a vessel in the first instance; and in the second, with a comparison between the disturbance caused by a vessel and that due to the movements of fish and cetaceans; but I think Mr. Cornish might well devote his attention, with valuable practical results, to the neutral zone on the coast-line. I believe the matter has been investigated by some foreign observer, who found that the advancing wave carries stones up the beach, while below a

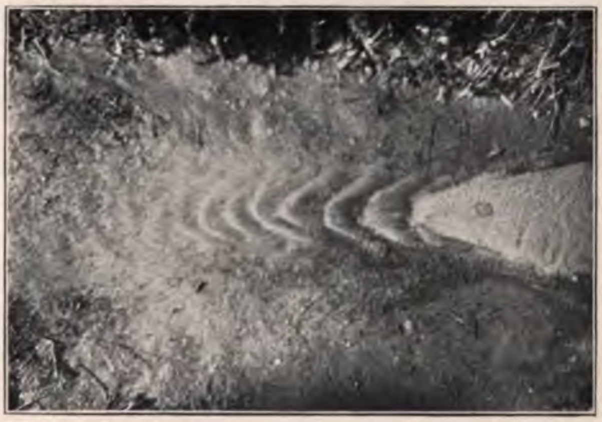
PLATE II.

A



Rippling of the froth of the breakers by a strong cross wind.
From a photograph by the author.

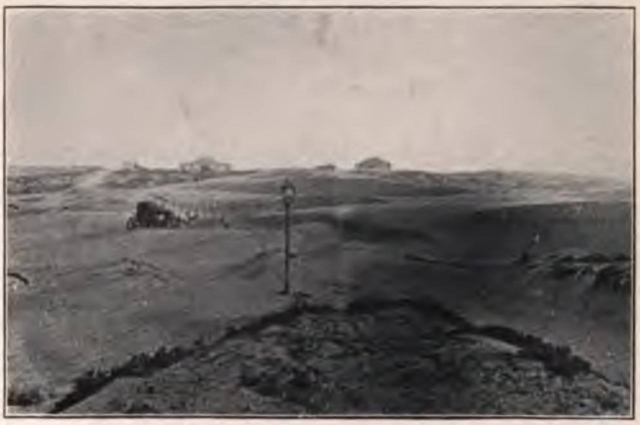
B



Ripple-drift structure left by subsidence of water from temporary rivulet caused by a thunderstorm.

From a photograph by the author.

C



Sand Dunes advancing from the shore and blocking the road between Clifton and Karachi.

From a photograph by Mr F. K. Cunliff

certain depth it carries them away from the beach. The line of no movement he calls the "neutral line." The position of this neutral line is a matter of considerable importance in the building of harbours, as was lately exemplified in the new harbour at Dover, which has been inaccessible at certain times owing to the fearful turmoil of the sea produced by some deflection of the waves. This harbour difficulty might possibly have been avoided by a better knowledge of wave-action.

Mr. Cornish's very interesting observations, and his study of these special wave-actions, should lead to a better understanding of this most important subject.

Dr. H. R. **Mill**: We have this session been favoured with a number of papers dealing with physical geography, but this is the first which has broken entirely new ground, has presented a new aspect of geography, and given a new name to it. It is not many years since the name of limnology was created; shortly afterwards we had speleology, both of these being departments of minute specialization; but kumatology, which Mr. Cornish proposes to introduce, is, in a sense, a more important subject than these, because it is not a minute specialization, but one of those generalizations which makes geography so distinctive as a science; it embraces not only air, water, and land, but the sand that drifts over the surface of the land. We remember the extremely brilliant but unfortunately unpublished paper by Prof. Lapworth some years ago, in which he proposed to explain the origin of continent and ocean basin by a theory of the crest and troughs of great waves vibrating round the world. We can thus see that the wave-idea runs through the whole field of geography, from the upper limit of our atmosphere down to the inner core of the Earth. There is one thing that has curiously escaped my memory when I have spoken to Mr. Cornish—that is, the singular appearance of water-waves under a thin sheet of perfectly elastic ice. When a steamer is running through a thin layer of ice, resting uniformly on a still surface of water, one sees the waves from the propeller proceeding unchecked under the ice, the surface of which responds to the movement of the waves without breaking. At the time I observed this phenomenon, fourteen years ago, I had no camera, and was unable to take photographs.

I should like to call attention to the great interest and originality of many of the photographs, some of which were obtained with great difficulty, and not without a little danger. The photograph of the crossing of two waves, strikes me as one of the most beautiful I have seen upon the screen.

Dr. **Arthur Haydon**: There is one important point to which Mr. Vaughan Cornish in his most excellent paper has, however, not referred. This is the curious action of the waves on "a boat that propels itself." This boat has no engines, does not go by steam, electricity, or man-power, and yet as you sit quietly in her and do nothing, she will move of her own motion against wind and wave at a speed of from 3 to 4 miles an hour—the rougher the sea, the faster she moves. The fact is, the boat is propelled by the action of the waves, as in perfectly still water she would not move at all.

The cause of her propulsion can be explained in the following manner: Two pieces of apparatus, something like gridirons, are fixed one at the bow and one at the stern, about on a level with the keel; they are strips of hardened steel, with their free ends pointing in the reverse direction to the course of the boat. Each frame holds four of these. They are 20 inches long, and 10 inches wide; they are $\frac{7}{16}$ of an inch thick at their union with their frames, and taper off to $\frac{1}{16}$ of an inch at their free ends. The dimensions of this boat are: length, 13 feet; breadth, 3 feet; depth, 20 inches; weight, 400 lbs. The two sets of steel fins weigh about 80 lbs., and from their position act effectually as partial ballast.

The explanation of the action of the waves on the above is as follows: When the boat is rolling and pitching, every roll and pitch moves these steel fins, and they are constantly returning to their original position by their own elasticity. The consequence is that as long as the rolling and pitching of the boat continues, they act like the fins and tail of a fish, and push and pull the boat along. I shall be glad to hear some scientific explanation of these phenomena.

The PRESIDENT: With reference to the ripples on the sand caused by the wind, I cannot help hoping that Captain Egerton will consent to describe to the meeting the phenomenon of sastrugi, of which he has had great experience in the arctic regions, as it has some analogy to this movement of the sand.

Captain EGERTON: I really don't know what I have to do with sand; I didn't realize that the sastrugi of the snow was the same thing. I have no doubt it is due to the wind. I can't say much about it, except that I know it curves the snow up very much like the photographs we have seen of sand, and at certain times in the spring it becomes very uncomfortable stuff to travel over; it makes a hard crusty surface partially hollow underneath, and as you are tramping along with the sledge you put your foot on it, the other follows, and down you come and bite your tongue. I really don't know anything else about it.

The PRESIDENT: It only remains to thank Mr. Vaughan Cornish. It has struck me that this paper is essentially an educational paper; it reminds us of how much there is of scientific interest in phenomena which are quite of everyday familiarity. We cannot go out of our own doors without seeing objects of interest if we choose to think; even the worn-out flagstones before our areas give food for reflection, thought, and study. I should not be in the least surprised, when I go to study duck waves to-morrow in St. James's Park, to find many of my friends here this evening studying them also. I shall be still less surprised if, when Mr. Vaughan Cornish proceeds, on the same scientific basis, to give us an account of his study of deep-sea waves at one of our afternoon meetings, he has a very large audience amongst those who have heard the interesting and suggestive paper this evening. I will now propose to you a very cordial vote of thanks to Mr. Vaughan Cornish for his paper.

EXPLORATION IN SARIKOL.*

By Captain H. H. P. DEASY.

LEAVING Yarkand on November 3, 1898, I went *viâ* Kosharab, the Arpatalak Dawan, and Khandar Dawan to the upper part of the valley called Wacha by Kirghiz, and Uchi by its inhabitants. Here several days were spent in obtaining the correct longitude of my starting-point by means of triangulation. As soon as the sub-surveyor, whom the Survey of India had most kindly lent me, had finished the topographical work, a start was made for the country erroneously called Mariom Pamir. The real name of this narrow valley, inhabited by Tajiks, is Mariong, and it extends in latitude from 37° 23′ N. to 37° 19′ N., at the junction with the Yarkand river, in long. 75° 55′ E. From Nosh Tans, the largest village in Mariong, I tried to find a route to the west end of Raskam along the valley of the Yarkand river, but its tortuous course, its great depth, and its precipitous banks, several thousand feet high, rendered progress difficult, if not impossible. It was during this period that a very striking loop of the Yarkand river was discovered, about 10 miles in length, with only about 1½ mile separating the upper stretch from the lower.

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* Dated "Kashgar, March 7, 1899."

Owing to the inhabitants of Mariong having refused to show me the direct route to the west end of Raskam, I was compelled to make a long *détour viâ* the Pichanyart Dawan and Sanglash. During this nine days' march five passes, one over 17,000 feet, were crossed in mid-winter, and camp was pitched on the right bank of the Yarkand river, only 11 miles distant from the most southerly part reached from Mariong. Once more unnecessary trouble was experienced, as the Tajiks who acted as guides, although professing to be anxious to render every assistance, brought me over a very bad and high pass and along a vile track, which was fortunately avoided on the return journey, at the expense indeed of an extra day's march and the crossing of four other passes, one being nearly 17,000 feet in height.

In order to give some idea of the difficult nature of the country, it may be mentioned that eleven passes, averaging about 14,700 feet, were crossed in fourteen days. The intervening valleys were very deep and narrow, and were in many places choked with dense jungle; and the track was sometimes so steep and difficult that even unladen animals could only, when assisted by men, pass along with any degree of safety.

Having carried on topographical work up to the point where it was brought in the previous winter, I checked the longitude of the west end of Raskam, and then went to the Kulan Urgi valley to check the longitude of the place where I had taken a series of lunar observations in January, 1898. Thence I descended that valley to Tir, a small village about 5 miles from the junction of the Kulan Urgi and Yarkand rivers, in lat. 37° 21′ N. and long. 76° 16′ E. From Tir short excursions were made up the Yarkand river to near Sanglash, to the Kuramut Dawan, and lastly to the Sandal Dawan, both of which are very high, steep, and exceedingly stony, especially the former. As soon as the Yarkand river was sufficiently frozen, I left Tir and followed that river down to the mouth of the Danga-bash, or Tashkurghan river, as it is called in the lower part of its course, in lat. 37° 50′ N. I had hoped to be able to follow this river down to Kosarab, but that was found to be impossible owing to the absence of ice and the precipitous banks, quite impracticable for animals at the two places where the river was not frozen, so a *détour* had to be made, partially along the Danga-bash river, to Kosarab. From Kosarab I ascended the Yarkand river with a small caravan as far as animals could go, and thence went on foot to the mouth of the Danga-bash river. I was by no means loth to return to Kosarab (having completed the exploration and survey of the Yarkand river from Raskam northwards), with easier routes in prospect, as well as the probability of having houses in which to pass the nights. Since leaving the Wacha valley on November 28, eleven nights had been spent in the open, the average minimum temperature being +5° Fahr.

Owing to illness during the previous winter, the surveyor was not able to survey the country between Chumdi and the Sandal Dawan, so a short excursion was made from the former place to fill in this gap, and survey the Asgan-sal river up to its sources close to the Sandal and Kuramut passes. After returning to Chundi to get observations for rates, I continued along the right bank of the Yarkand river to where the Khotan road crosses it, and reached Yarkand on February 2. Throughout this journey the weather was exceptionally fine, but cold, and at only two places did it prevent me from taking observations. Frequent good rates were obtained for the chronometer watches, which maintained such satisfactory rates that the error in longitude on arrival at Yarkand was only 0·7 second. The longitude of my observing-station, close to the old town of Yarkand, was carefully determined in March, 1898, permission to observe in the Yangi-Shahr, where Trotter observed, having been obtained through the kind help of Mr. G. Macartney. This value was checked by an occultation observed in October, 1898, and found to be correct.

After a brief but much needed halt in Yarkand, I took a circuitous route, best known as the Khan Arik route, to Kashgar; and was fortunately enabled to fix astronomically the positions of four places not shown on any map, and check that of Khanarik, which is in lat. 39° 16′ N., long. 76° 37′ E., or about 2′ S. and 17′ E. of the position previously ascribed to it.

During my journey to Sarikol and adjacent country, about 4000 square miles of country were surveyed, on the scale of 8 miles to one inch, by the hard-working and competent topographer whom the survey of India kindly lent me. Frequently it was necessary to send two men with the surveyor to hold up numnahs to partially protect him from the biting winds on the high passes, when the temperature was often below zero; and no small amount of praise is due to this man for carrying on work under such very trying circumstances. The positions of thirty-three places were determined astronomically by me, and the longitudes of twenty-eight other places, where I had observed in the previous winter, checked.

A POPULAR TREATISE ON THE TIDES.*

"A MATHEMATICAL argument is, after all, only organized common sense, and it is well that men of science should not always expound their work to the few behind a veil of technical language, but should from time to time explain to a larger public the reasoning which lies behind their mathematical notation." "To a man unversed in popular exposition, it needs a great effort to shell away the apparatus of investigation and the technical mode of speech from the thing behind it. . . ." In order to justify our use of the word "popular" in describing this book, we need only add to the foregoing sentences from the author's preface the statement that, while it treats of some of the most recondite mathematical investigations of modern times, it does so in a manner which must be perfectly intelligible to any reader who can devote a reasonable amount of attention to what he reads, and that without the use of a single mathematical symbol. Probably no branch of terrestrial physics has suffered more from popular exposition of the sort which has been characterized once for all as "pernicious just in proportion as it is the outcome of presumptuous ignorance" than the tides and their kindred phenomena; and a really lucid explanation of the results of mathematical research forms a contribution to popular geographical literature which has long been sorely needed. We can only express the hope that Prof. Darwin's example may be largely imitated; the effort he speaks of as necessary to the production of books of this stamp is undoubtedly great, but if it were made oftener, the effect on ordinary class-books and on teaching generally would soon become apparent. It is probable that hardly any professed geographer living could appreciate the full significance of Prof. Darwin's or Lord Kelvin's original papers on the tides, but without a knowledge of their results he cannot teach sound doctrine about tides, and that knowledge must be obtained either from the original papers or from books like this or the "Popular Lectures." Failing original papers, he falls back on these popular summaries, both of which have the supreme merit of assigning clearly the limit of popular exposition, of stopping short at the point where it begins to be so inadequate as to be misleading, and where the student must be content to employ mathematics explicitly or remain in ignorance.

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* 'The Tides and Kindred Phenomena in the Solar System.' By Prof. G. H. Darwin. London: John Murray.

Prof. Darwin's book is the substance of a course of lectures on the Tides, delivered at the Lowell Institute in Boston in 1897, merely deprived of their personal form; parts of these lectures have already been published in the American monthlies. The first chapter treats of tidal observations; tide-gauges and their modes of action are described, and a number of typical tide-records are examined, leading to definitions of tidal phenomena, and incidentally to points to be considered in selecting positions for making observations.

Chapter II. deals with seiches in lakes, and begins with an excellent appreciation of Prof. Forel and his papers. Forel's researches on the seiches of Lake Geneva are described in some detail, and explained with the help of an admirable summary of the principles of wave-motion, which is made constant use of in the later portions of the book. This chapter ends with a short account of atmospheric wave-surfaces, mackerel skies, and the like. Then follows a chapter on tide-phenomena in rivers, consisting chiefly of an account of the survey of bore-phenomena on the Tsien-Tang-Kiang, by Captain Moore, R.N., of H.M.S. *Rambler*, with a number of very striking illustrations. Next we have an interesting chapter on the history of knowledge of the tides, compiled with the assistance, in its earlier parts, of Cambridge experts in Chinese, Arabic, Icelandic, and classical literatures. Then follows the crucial chapter on tide-generating force.

It is frankly admitted at the beginning that mathematical reasoning is absolutely necessary to a full explanation of how the attractions of the sun and moon give rise to the tide-generating force, but the endeavour is made to give as full an explanation as possible without the use of technical language or symbols. The explanation given is perfectly lucid throughout, and with the possible exception of one or two steps, quite simple. At any rate, there can be no possible doubt left after reading the chapter that "since on the whole the attractions and the centrifugal forces are equal and opposite, and since the centrifugal forces acting on a non-rotating Earth are equal and parallel at every part, and since the attraction at the Earth's centre is the average attraction, it follows that where the attraction is stronger than the average it overbalances the centrifugal force, and where it is weaker it is overbalanced thereby." And this, after all, is the foundation of a proper understanding of the cause of the tides, although markedly different from that usually found in elementary text-books.

The intensity of the tide-generating force being conveniently measured by reference to gravity as a standard, the next chapters treat naturally of the "deflection of the vertical." Calculations are made showing the extreme minuteness of the deflection to be measured, and an account is given of G. H. and Horace Darwin's attempts to make the measurements, of the bearings of modern seismology on the results, and of the general problems of the elastic distortion of the Earth's surface by varying loads.

The next two chapters are devoted to a luminous exposition of the equilibrium and dynamical theories of the tides. In the equilibrium theory "everything is to remain as in reality except time, which is to be indefinitely protracted." The theory is then built up, and the general agreement with observed fact pointed out. Then the discrepancies are noted, and explained by means of Newton's dynamical theory, the conditions being brought gradually into closer and closer agreement with reality.

Chapter X. considers the application of theory to simpler cases of tides, as in small lakes, and the complexities of oceanic tides are then traced by the use of cotidal lines, the need for a revision and extension (especially in the Pacific) of Whewell and Airy's cotidal charts being emphasized. This leads to methods of tide-prediction in everyday use:

Chapter XI. describes the harmonic analysis of tides by substitution of imaginary satellites for the sun and moon; Chapter XII. the actual methods of reducing tidal observations and determining the fifteen or twenty pairs of constants required to form a complete record of the behaviour of the sea at a particular place; and Chapter XIII. the use of Kelvin's harmonic analyzer in constructing tide-predicting tables from known constants.

After a comparison of tides predicted and observed, chiefly at Portsmouth, which gives an estimate of the degree of accuracy attainable in tide-predicting, Prof. Darwin leaves the subject of sea-tides, and the remainder of the book treats of tidal problems of a more general order. Of the chapters on the rigidity of the Earth, on tidal friction, on figures of equilibrium in a rotating mass of liquid, on the nebular theory, and on Saturn's rings, it would be difficult to say which is the finest example of popular treatment of the best sort. We commend them to the study of geomorphologists.

Not the least merit of this admirable book is the list of references to authorities at the end of each chapter. The part most susceptible of improvement is perhaps the illustrations; we should like to see more of them in the next edition; and a few, notably Fig. 23, might be made somewhat clearer or explained more fully.

THE ENGLISH EXPEDITION TO SOKOTRA.

By Dr. H. O. FORBES.

THIS expedition was undertaken conjointly by the British and Liverpool Museums, aided by the Royal Society of London, the Royal Geographical Society, and the British Association, with the zoological investigation of the island as its main object. The members were the Director of the Liverpool Museums (Dr. H. O. Forbes) and Mr. W. R. Ogilvie-Grant, of the British Museum. An experienced taxidermist from the former institution, six Somali servants, and a native officer, with one sowar from the Aden troop, completed the party. Dr. Forbes has sent us the following account of the expedition:—

We left England on October 28, 1898, on board the British India steamer *Manora*. Through arrangements kindly permitted by the directors of the company, and made by Captain Henderson, a collection of the *plankton* all the way from the English Channel to Aden was continuously kept up, by attaching grit-gauze nets to one of the pumps constantly in action when the steamer was under way.

We arrived in Aden on November 18, but, on being received by the Political Resident, Brigadier-General Creagh, V.C., we were deeply disappointed to learn that political difficulties, which had arisen between the Indian Government and the Sultan of Sokotra, would probably prevent our proceeding to our destination. The general displayed the greatest sympathy with us in our disappointment, and without delay communicated on the subject with the Indian authorities. Meanwhile we were assisted in the very kindest manner, both by the Resident and by Captain Jacob, the First Political Assistant, to tide over the detention unavoidable to the negotiations, as profitably to the objects of our journey as possible. The general lent us the Government bungalow at Sheik Othman, some 12 miles from Aden; and recommended us to the Sultan of Lakej, from whom we received a cordial invitation to visit his territory, and, should it be impossible to proceed to Sokotra, to make as prolonged a stay in it as we desired. On November 27, however, we were recalled from Lakej by the arrival of a telegram from the Indian Government, authorizing our visit to Sokotra. Hurrying back, therefore, to Aden, we engaged the necessary servants and embarked on December 1, on board the *Elphinstone*, a steamer of the Royal Indian Marine, which the Government of India had generously placed at our disposal to convey us to and from the island.

Just before our departure, we had the satisfaction of making the acquaintance of the members of the Austrian Expedition to Arabia, which was chiefly in quest of Himyaritic inscriptions—Count Landberg, Dr. H. Müller, Dr. Kossmat, and Prof. Simony. This expedition, later on, also visited Sokotra, and we had the pleasure of receiving several of the party at our camp at Adho Dimellus.

The outward voyage was broken at Abd-el-Kuri, an islet lying some 200 miles east of Guardafui, which had never before been scientifically investigated. The *Elphinstone* anchored at Bander Saleh, on the south coast, and four days were spent in making zoological, botanical, and geological collections, among which several animals and plants have proved new to science. The geological structure of the island is very similar to that of Sokotra. It has suffered great denudation, however, for the limestone, which is of both Cretaceous and Tertiary age, has disappeared everywhere, except on one or two summits. Volcanic rocks abound, and from the high peak—1750 feet in height—overlooking our anchorage they resembled a number of papillæ rising from a desert of sand. The island has but few inhabitants, who are very poor and miserably housed. Some of them are fishers and divers for pearl-shell. Numerous chelonian carapaces strewn about near their huts indicated that the hawk's-bill turtle was a common frequenter of their coasts. The most notable feature of the vegetation was the absence of those characteristic plants of Sokotra, the dragon's blood (*Dracæna cinnabari*, and other species of the genus), the myrrh and the frankincense trees, though Abd-el-Kuri lies nearer to the African coast than the main island.

On December 6 the *Elphinstone* continued on her voyage to Sokotra, when, after landing us near Hadibu, she returned to Aden. Our first camp was placed on the banks of the Hanefu, in the beautiful plain south of the capital, where collections were commenced, a base for the survey measured, and astronomical observations taken. The Sultan was at first not too favourably inclined to us, and the people avaricious and averse to giving us information about the roads and passes of the country, which caused us not a little loss of time. On the 18th of the month we moved our camp to Dahamis, lying under the peak of Aduna, at 740 feet, in a valley looking north-east. Here, on the fourteenth day after our landing, fever of a malignant and very intractable type appeared among us. It was rarely preceded by an ague stage, but was marked by lengthy periods of unbroken high temperature, often reaching 106° Fahr., and by irreducible sickness. Our Somali, Arab, and Indian companions suffered equally with ourselves.

From Dahamis we moved first to Kamahanu, a hill in the Garieh plain, and then to Jena-agahan, a still higher altitude, in the hope of getting rid of the fever. Jena-agahan is a flat eminence on one of the spurs of the Haghier range. The name Haghier, by the way, signifies "white rocks," a designation applied to them, no doubt, from the white lichen which entirely covers the bare granite summits, which present a striking contrast to the red of the lower slopes, on which the plant does not thrive. On the plain below our camp the wild ass, which most travellers to the island have mentioned, roamed in considerable herds. Larger than the domestic animal, it is a strong, square-built beast, with a pure white muzzle, and white margins to its not over-long ears; above, it is slaty-grey, with a black stripe across its shoulders, and another down its back to the tip of the tail. Its under-surface is white, with the exception of two black anklets. It closely resembles the onagar, and it may perhaps prove to be a new indigenous species, although by some naturalists it is considered to be but the common ass escaped from captivity. In many parts of the plain occur long lines of large stones laid out on the ground amid the scrub, placed there, as the natives tell, by the "Kafirs" "long ago." They look like boundary fences, only they are not long enough, and the directions they pursue are too irregular for such a purpose. In this district of the Haghier mountains we found, high up on the summits, the dragon's-blood tree in great abundance, myrrh and frankincense trees also, and candelabra-like euphorbias—all specially characteristic of the Sokotra flora. In the sunny ravines near our camp insects were abundant, especially a fine new species of *Charaxes*, recently described by Mr. Grant under the name of *C. velox* in the *Bulletin of the Liverpool Museums*, vol. ii. May, 1899, where in pages 1 to 13 will be found the descriptions of the more conspicuous novelties in the groups so far examined, obtained during the expedition.

On January 15, once more shifting our quarters, and crossing the Garieh plain eastward, we camped on the plateau of Homhil (1700 feet in height), in a curious parabolic amphitheatre a couple of miles wide, whose walls were of limestone nearly 1000 feet high, and its floor of archæan rocks from which the limestone has apparently been removed by some remarkable process of denudation. Part of this limestone is, from various indications, probably contemporaneous with that out of which the peaks of Sinai protrude. This plateau is the nearest approach the limestone formation makes to the spurs of the Haghier mountains on their eastern face; the whole width of the Garieh plain separates the one from the other. All round the bases of the southern and western spurs of this orographic block the limestone overlies the granite.

Our sojourn at Homhil proved a very profitable one. The health of the camp improved amazingly, notwithstanding that fever was prevalent among the Sokoteri, and occasionally appeared among our own natives, and mosquitoes showed no decrease in numbers. The vegetation on the limestone flanks and summits of Hamaderu and Matagoti was rich and abundant. Dorstenias, Adeniums, Trichodesmas (of two varieties, deep blue and pure white), Exacums (the most beautiful and sweetly scented of gentians), with a luxuriant shrubbery of boxwood (*Buxus hildebrandti*), afforded interest and pleasure of no ordinary kind.

Leaving Homhil, we turned westwards and ascended to Adho Dimellus, at an elevation of about 4000 feet, in the centre of the Haghier *massif*, and just under Ferahe, its culminating peak. Our camp was pitched nearly on the water-parting of three deep cañon-like valleys, stretching one to the north and two to the south. The granite walls of the latter were in many places sheer precipices of great height, and the valleys between them look like gigantic fault-blocks which have dropped bodily down. This was one of the most salubrious, picturesque, and exhilarating regions imaginable, and it is difficult to express the supreme enjoyment of our stay there. The ground was densely clad with Euryops and Hypericums, of which one splendid species, a large bushy shrub, was everywhere starred over with blossoms exceeding in size and depth of golden yellow those of our own Large-flowering St. John's-wort. The open spaces between the boulders—which in Sokotra everywhere cover the surface—and the bushes were carpeted with Cystistemons and deep-blue Trichodesmas; while against the bare rock-faces, and sharing the almost soil-less clefts of the granite with the Exacums, the Sokotran Begonia spread its orbicular leaves and thrust up its fine heads of rich pink flowers. On the precipitous slopes grew, in greater abundance than we observed elsewhere, both Boswellias and Balsamodendrons (the myrrh and frankincense trees); and the very highest pinnacles were held by the largest of the dragon's-blood trees. Indeed, it is mainly on the highest regions of the range that the more peculiar flora of the island is developed.

Near our camp also were extensive meadow-like areas—the pasture-grounds of large herds of the shapely and inquisitive little cattle of the island—over which are dotted the ruins of square mortar-built houses, of ancient circular cyclopean dwellings resembling somewhat those to be seen in parts of Mashonaland, long stone dykes, and large antique corn-mortars, erected and set up by people of whom the present inhabitants have no knowledge.

Owing to our detention in Aden, and the time subsequently lost through sickness, it was impossible for us to extend our investigations, as we had intended, to the western portion of the island. On February 18 the expedition had regretfully to pack up and return to Hadibu, to await the return of the *Elphinstone* to carry us back to Aden. On the 21st we embarked, and, after a couple of days spent in revisiting Abd-el-Kuri, reached Aden on the 26th.

As the fauna of Sokotra appears, in our experience, to be pretty uniformly distributed from the coast to the mountain-tops, we have probably, therefore, obtained representatives of most of the species on the island. On the other hand, much of the flora of the higher altitudes is not to be found in the lowlands. Botany was not a special object of investigation with us, as, after the very thorough examination of the island by Prof. Balfour, we could not expect to add many new plants; still, a few undescribed species have been obtained. In this department our time was chiefly devoted to collecting seeds and living specimens, of which a large number of great horticultural and scientific interest have been successfully transferred to this country.

Our contributions to the anthropology of Sokotra are, unfortunately, not very extensive. The shyness and fanaticism of the people, together with the difficulties of the language, even with the services of an excellent interpreter at one's command, are almost insuperable hindrances to obtaining accurate information in this department during a short visit.

The portion of the island visited by us has been surveyed with some care, and a considerable number of astronomical observations have been obtained. The map published by Wellsted we found to be extremely inaccurate everywhere except as regards the coast-line.

When the members of the Austrian expedition visited us at Adho Dimellus in February, they very generously proposed to wait for the publication of our biological collections before issuing the results of theirs, so as to prevent the duplication of types. In order, also, that the survey should be as complete as possible, it was agreed that the observations of both expeditions should be incorporated in one, probably a combined topographical and geological, map, for Prof. Kosmat's geological investigations are very extensive; they will undoubtedly prove of the highest value.

A fully illustrated account of the biological results of our expedition will shortly appear as a special *Bulletin of the Liverpool Museums.*

THE AUSTRIAN EXPEDITION TO SOUTHERN ARABIA AND SOKOTRA.*

It was originally intended that the expedition despatched to Southern Arabia, in the autumn of 1898, by the Imperial Academy of Sciences of Vienna, should penetrate into the interior of Hadramaut, and carry out exhaustive explorations there. On the discovery, however, of the unfavourable relations existing between Count Landberg and the Sultans of the interior, it became necessary to abandon this plan. Dr. David Müller, who, on the retirement of the count, took over the command of the expedition on December 18, decided to divide the party, and therefore commissioned the Englishman, Mr. Bury, who was under an agreement with Count Landberg, to endeavour to reach Ansab Shabwa, where hundreds of inscriptions were reported to exist; while he himself, accompanied by the major part of the expedition, proceeded to Sokotra, provided with recommendations from the British Government. Disguised as an Arab and accompanied by four natives, Mr. Bury met with some success, although the reports of abundance of inscriptions at Shabwa proved unfounded. His surveys, collections, and reports, as well as the inscriptions found at other places within the district traversed, are of much value, the last named both historically and linguistically. With the inscriptions obtained by Dr. Müller himself, the sum-total of the archæological material brought back is by no means inconsiderable, though falling short of the expectations originally entertained with respect to it; many inscriptions from previously unknown districts—all in the Hadramaut dialect—having been rendered accessible to students. Valuable results, too, as regards the topography of the interior of Hadramaut and the north coast of the Gulf of Aden, have been gained from Professor Müller's own observations during his journey through the Wadi Maifaa, from the port of Ba-el-Haf (between Aden and Makalla) to Azzan, the picturesque rock-fortress of Sultan Muhsin, as well as from Mr. Bury's surveys.

The linguistic results of the expedition are, however, of especial importance. The Mahran language (spoken throughout the central portion of the southern Arabian coast—roughly between Makalla and the Kuria-Muria islands), which was previously but very imperfectly known in Europe, was investigated by two observers, Dr. Müller and Dr. Alfred Zahn, both of whom obtained numerous original relations and long poems from the mouths of the people themselves. The latter has collected an extensive vocabulary, while Dr. Müller has succeeded in translating biblical stories of considerable length into Mahran. As, therefore, the results obtained from Southern Arabia on the side of the geology, fauna, and flora are also considerable, the expedition cannot be said to have resulted in failure, but only to have been reduced in scope, in so far as Southern Arabia was its goal. When, however, we look at the additional results obtained by the exploration of Sokotra and the other islands in its vicinity, we can only say that the general outcome of the expedition has been a valuable and important addition to our knowledge.

The language of Sokotra, which is spoken in greatest purity in the mountains, was practically unknown in Europe. Dr. Müller has now, however, obtained copies of many original texts, together with translations, and has collected about seventy small poems, which are in part not unworthy to rank with the celebrated old Arabian poems of the Hamasa. Both languages—Mahran and Sokotran—present much interest from the point of view of the geography of culture. We have here to do not with Arabian dialects in the narrower sense of the term, but with idioms which are daughter-tongues of the old Sabæan and Minæan, and present to the philological student some very peculiar phenomena. They form the most southerly outposts of the Semitic group of languages, and, while supplying answers to a series of problems, present on the other hand new enigmas to the scientific inquirer. They stand in the same relation to the speech of the old inscriptions as Coptic does to that of the Hieroglyphics. The question of the relation of the Mahran to the Sokotran language likewise merits attention. Just as Sokotra is at the present day in close contact with the Mahra coast—the same dynasty rules both at Kishin and at Tamarida—a close connection was maintained too in the most ancient times. The Sokotran language has therefore without doubt been derived from the Mahra countries, but the differences between it and Mahran are at the present day so important that natives of the two districts cannot understand each other. Both as regards words and grammar, Sokotran bears throughout evidence of greater age. On the Arabian coast the ancient tongue has been modified by Arabic and other foreign influences, and certain old forms have been obliterated, while in the mountains of Sokotra they have maintained their ground.

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* From the preliminary reports of Professors David Müller, Oskar Simony, and Franz Kossmat; communicated by Dr. Peucker.

The above details are taken from the preliminary account of the leader of the expedition, Professor David Müller. The flora and fauna of the regions visited form the subject of a report by Dr. Oskar Simony. In consequence of the lengthened but involuntary stay of the ship at the port of Aden, the botany and zoology of that neighbourhood, including its culminating point, were pretty exhaustively investigated, whereas the short inland journey from Ba-el-Haf to Azzan produced only fragmentary results from these points of view. The collections obtained would have been quite inadequate had it not been that, thanks to the energy of Professor Müller, two other interesting points on the coast, Ras Fartak and Makalla, were visited before the close of the undertaking, excursions being also made into the adjoining mountain valleys, from which good results were gained. By this means sufficiently detailed evidence was obtained of the close connection between the flora and fauna of Southern Arabia and those of East Africa. An especial interest seems to be presented by a species of *Boswellia*, of which numerous specimens were obtained from the frankincense district north of Ras Fartak, a sufficient quantity of the wood for quantitative chemical analysis being brought back. The same district produces a new lizard belonging to the genus *Uromastix*, as well as large numbers of Lepidoptera and Hymenoptera, in part new, whence we may conclude that from the point of view of the entomologist important results would be obtained from a further advance into the mountainous interior.

The facilities for a thorough investigation of the zoology and botany of Sokotra, Abd-el-kuri and Semha, were beyond comparison more favourable. The *Gottfried*, the steamer of the expedition, was able to run in, in rapid succession, to numerous points on the coast, and it was therefore possible, especially in Sokotra, to obtain very much more detailed information than was hitherto available as regards the geographical distribution of many species, a large number of East African forms, especially among the insects, being collected on the coasts; while the central range of the island, of which both the principal peaks were with some difficulty ascended, afforded a number of species characteristic of Sokotra. Special interest was likewise found to attach to the fish-fauna of the extensive lagoons situated near the mouths of many of the streams; the supply of fresh water becoming very scanty during the dry season, at which time, simultaneously with the advance of the heavier sea-water, a migration of marine fish into the deepest parts of the basins is observed. At a distance of 6 miles from the coast two rays of considerable size were captured, in addition to many smaller sea-fish, among which a fine *Blennius* was included.

The whole zoological and botanical material includes about three hundred and fifty species of phanerogams, with many preparations in spirits; five hundred species of insects of all orders, including, first and foremost, about four thousand specimens of Lepidoptera and Hymenoptera; as well as about seventy species of reptiles and fishes, represented by, roughly, four hundred specimens.

Owing to the amount of canvas with which the steamer was covered, trustworthy observations of temperature were impossible on board. They were made, however, on the separate excursions, but a maximum shade temperature of 94° Fahr. was never exceeded, either on the mainland or on the islands. Lastly, numerous barometric determinations of altitude were made, and about three hundred photographs taken, consisting in part of landscapes, in part of representations of instructive morphological phenomena or characteristic forms of vegetation.

In conclusion, the following supplementary details may be given respecting the interesting geological observations of Dr. Kossmat, briefly referred to in the May number of the *Journal*. The first sphere of operations was the classical volcanic region of Aden and the peninsula of Gebel Ihsan, west of the same. Here a large number of interesting rock specimens was collected. These studies were supplemented by important researches in the neighbourhood of Ba-el-Haf, which is characterized by a great abundance of small but particularly well-preserved volcanoes. The journey through the Wadi Maifaa led into the region of horizontally bedded sedimentary formations of older Tertiary age, which come to the surface behind the volcanic coast-zone and spread with great uniformity over wide areas. The islands of Sokotra, Abd-el-Kuri, and Semha are so placed as to form an important link between Southern Arabia and North-east Africa, and for this reason are peculiarly adapted for geophysical studies, while on the other hand the compactness of this small archipelago allowed a certain degree of completeness to be reached in its investigation. Observations of a comparative nature were made on the Mahra coast and in the neighbourhood of Makalla, and the value of the study of the islands is thereby enhanced. On the strip of coast just mentioned the stratified limestone of inner Arabia reaches the sea, so that the investigations made here complete in many ways the observations, necessarily imperfect, carried out in the Wadi Maifaa. The sum-total of the results achieved will form a useful contribution to the geological history of the districts visited, and even to our knowledge of the development of the Mediterranean region during the Cretaceous and Tertiary epochs.

THE GERMAN DEEP-SEA EXPEDITION IN ANTARCTIC WATERS.*

The German Deep-Sea Expedition, on board the *Valdivia*, under the leadership of Prof. Chun, returned to Hamburg on April 30, and were received with great enthusiasm by representatives of the German Emperor, of the German Government, of the government of the Free Town of Hamburg, and of various scientific and learned societies. Sir John Murray, who took part in the proceedings, conveyed the congratulations of British geographers and men of science on the extremely successful manner in which the expedition had been carried out, and on the results it had secured.

In consideration of the important bearing of the part of the cruise which lay in the Southern ocean on the future of antarctic exploration, we publish, as a sequel to Prof. Chun's letter and map in the March number, p. 297, the following translation of the official report in the *Deutsche Reichs-Anzeiger* of March 25, 1899. The summaries of the scientific results are somewhat condensed, but the narrative of the voyage is given in full.

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* For chart see p. 336, *antea*.

I. From Capetown to Bouvet Island.

The *Valdivia* left Capetown in beautiful weather on Sunday, November 13, 1898. The favourable conditions lasted for several days, and allowed all the observations to be carried on in the best possible way. A sounding of 2280 fathoms on November 14 was particularly important, when taken in conjunction with earlier soundings, in giving the profile of the steep slope of the outer edge of the Agulhas bank. As we were now entering on a region where the configuration of the ocean-floor is entirely unknown, a sounding was made every day before commencing the rest of the scientific work. This was watched with the greatest interest, because it soon became apparent that the depths found were far greater than had been expected.

The influence of the "roaring forties" began to be felt in 37° S., in the form of a westerly swell, and on November 16 there was a north-westerly storm. Simultaneously with the westerly wind the expedition entered a region between 39° and 40° S. where the warm water of the Agulhas current spread out in a funnel shape into the cold antarctic drift. Remarkable changes in surface-temperature, amounting, on November 16, to a difference of nearly 13° Fahr., indicated the thinning away of the warm current, which was also visible to the eye, for stripes of sea-green warm water alternated with the deep-blue cold water. The changes of temperature often occurred so rapidly that it was hardly possible to read the thermometers fast enough to follow them. Still the hourly readings of this and the following day give a striking picture of the rapidly varying surface-temperature, and the cooling of the water which immediately followed. For instance, the surface-temperature at noon on the 16th was 63·3° Fahr., and on the 18th only 46·0°. It then fell so rapidly that on crossing the fifty-third parallel on November 24, the surface temperature was only 30·2° Fahr., *i.e.* below the freezing-point of fresh water. When the cold zone was entered on November 17 a simultaneous decrease in salinity was observed, the fall being from 35 per mille. to 34 per mille. and 33·8 per mille. From the 17th the weather remained so favourable, with moderate westerly winds and an occasional north-westerly swell, that it was possible to use the finest tow-nets in great depths. On the 20th a change came, the barometer dropped from 29·92 to 29·06 in., and the wind went round from north-east to south-west, and blew so heavily that it was necessary to put the ship head to sea until the 22nd, when the wind went back to the north-west with rain and hail showers, and the storm passed. The rapid fall of the barometer on the 20th was followed by an equally rapid rise on the 21st, when it reached the unusual height of 30·24 in. The storm was followed by some quieter days, but fog hindered rapid progress, and the steam-whistle had to be kept blowing, in the hope of detecting icebergs by the echo: this was done successfully on a later occasion.

On November 24 we reached the latitude of 54° S., near the place where the British Admiralty chart shows three islands under the general name of "Bouvet Group." * A keen north-east wind was blowing, the deck was covered with smooth ice, and driving fog frequently obscured the view; but when the sun broke through occasionally, the hope of discovering the fate of the islands revived. While during the previous days very considerable depths had been sounded (between 2000 and 3000 fathoms), the sounding on November 24 was only 1240 fathoms, indicating a submarine ridge which might serve as the base of the islands for which it was resolved to make a systematic search. For this purpose we had laid down on a chart, from the data in the 'Sailing Directions,' the positions in which land had been sighted by Bouvet, Lindsay, and Norris, and proceeded to test these by sailing from east to west along the assigned parallel. On the morning of the 25th, midway between the positions assigned by Bouvet and Lindsay, a depth of 1890 fathoms was obtained, but this unfavourable sign was to some extent counteracted by the extraordinary abundance of bird-life, not least by the capture of two large Cape pigeons (*Daption Capensis*), which had obviously not come far from their breeding-place. Snow-showers alternated with intervals of clear sky, and during the short night it was pretty clear, so that the search for the islands was pursued in a westerly direction. While the latitudes of the earlier voyages could be trusted, it was not unlikely that their longitudes were somewhat in error on account of the imperfect methods then in use. Sir James Ross supposed that the island sighted by Lindsay might lie a degree farther west, and it is apparently on his authority that the Admiralty chart shows it in long. 3° 10′ E., a position which we afterwards found to be nearly correct.

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* In the charts we have seen, the name "Bouvet Group" does not appear; but Lindsay, Bouvet, and Thompson islands are separately named.—Ed. *G. J.*

The first large iceberg was seen about noon on November 25, the heavy sea dashing in breakers upon it. The sky remained clear, and, in spite of the strong north-west wind, the sea became calmer. A little after 3 p.m. the cry of "Land ahead!" was heard, and soon the sharp outline of a steep island clothed in antarctic ice and desolation showed clear about 7 nautical miles distant. The first impression of this land, which had remained unseen for seventy-five years, and eluded three expeditions, was that of a steep and lofty slope on the west and north, on which a magnificent glacier descended to sea-level, and a vast snow-field above sinking gently to the south and ending with an ice-wall at the sea; the summit of the island was covered with clouds. The rediscovery of this island, in spite of stormy weather, frequent fogs, and the risk of collision with icebergs, is a remarkable tribute to the skill of the navigator of the ship.

In the lee of the island (on the south-east side) the longed-for opportunity of carrying on oceanic and biological observations presented itself. The island fell steeply to the sea, and, at a distance of from 3 to 4 nautical miles, depths of 200 to 300 fathoms were found, in which five hauls of the dredge were made. The result was an extraordinarily rich collection of animal life. Every group of marine organisms, except fishes and stalked crinoids, was represented. The results are not only of interest in a purely zoological sense, but also from the point of view of the distribution of animals. On the 26th a coast survey of the island was made, and photographs of the points to which bearings were taken were secured, so that the map can now be completed in detail.

The centre of Bouvet island is in lat. 54° 26·4′ S. and long. 3° 24·2′ E. Its length from west to east is 5·1, and from north to south 4·3 nautical miles. It is thus almost of the same size as the island of New Amsterdam in the Indian ocean, which we visited subsequently, and, like it, is of volcanic origin. Norris expressly stated this as one of the features of his Thompson island. No rock-specimen was obtained from the land, but the dredge came up filled with grey volcanic mud, containing portions of half-decomposed tuff and fine-grained basalt, which were preserved for careful examination. The distinctive form of the island was, however, the clearest proof of its volcanic nature, although we only saw it completely free from clouds on one occasion. A photograph * shows a wide, sharply indented crater-wall sloping gently to the sea on the south and east. The other sides are much steeper, the north-east cape being a prominent cliff. The highest point of the rim of the crater (3067 feet) was named Kaiser Wilhelm peak, as a memento of the interest taken by the German Emperor in the expedition. The northernmost of the five projecting angles of the island was named Cape Valdivia; a bay in which safe anchorage could be found was looked for in vain. Considering the small size of the island compared with South Georgia, which is situated in nearly the same latitude, the extent of the Bouvet island glacier is surprising. It can only be explained on the hypothesis that the Antarctic sea sends out a tongue of cold water in this direction, which is confirmed by the low surface-temperature and the low latitude of the edge of the pack-ice in this longitude. The whole island is covered with one vast glacier, which reaches sea-level on the gently sloping southern and eastern sides, where it forms an ice-wall 400 feet high. Scars on the sea-front show the places where small icebergs have broken away. On the steep slopes of the island the ice-wall is higher, clinging to the rocks as far as the ice-masses can retain a hold. A fine glacier with deep-blue crevasses descends steeply to the sea on the north side of the island, and a broader glacier comes down on the south side, the edge of which seems to be the only possible landing-place; but the high sea and frequent fogs made it impossible to test it. Steep cliffs or vertical ice-walls absolutely prohibit any attempt to land at any other point. The island seems to sink abruptly into the sea on every side, with few off-lying rocks.

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* See *Journal* for March, p. 298.

Both Bouvet and Lindsay had reported trees on the island, but no trace of vegetation could be ascertained from the *Valdivia*, although the land was carefully studied through telescopes from a distance of only 2 nautical miles. Animal life also appeared to be extremely sparse in contrast to most antarctic islands. Cape pigeons were the most abundant birds; other antarctic forms were not common. It is noteworthy that the white petrel (*Pagodroma nivea*), considered by Ross the surest sign of the proximity of ice, was first seen by us when cruising off Bouvet island.

Norris reported that 45 nautical miles north-north-east of Liverpool island (which may, perhaps, be considered as identical with the newly rediscovered land) there was a second island, which he named Thompson island. Here a party from his vessel landed to kill seals and penguins, and, on account of bad weather, were unable to regain the ship for seven days. On November 27 the *Valdivia* searched for this island, but failed to find it, the weather being stormy and foggy. At the spot assigned to Thompson island in the charts, a sounding of 1011 fathoms was obtained, and a little further east, 1270 fathoms. Returning to Bouvet island, another haul of the dredge was taken, and on the evening of November 28 the ship started southward for the edge of the ice-pack. A thick fog completely concealed the island, though only 2 miles distant, and it was easy to understand how Ross passed within 4 miles of it without seeing any sign of its existence. In the opinion of the leader of the expedition, Bouvet's Cap de la Circoncision, Lindsay island, and Liverpool island, are identical with the rediscovered land; but the discussion as to the existence of other islands in the neighbourhood would lead us beyond the limits of this article.

II. From Bouvet Island along the Edge of the Ice to near Enderby Land.

The second section of the cruise in antarctic waters may be looked upon as the most successful part of the expedition. Whether it was because the choice of the route brought us into the calm belt between the west-wind zone and the more southerly east-wind region, or whether fortune favoured us, the fact remains that the expedition found the most exceptionally fine weather, and was able to approach the shores of the antarctic continent in a ship quite unfitted for ice-navigation. Oceanographical work could be carried on without interruption; but yet, favourable as the conditions were, occasional fogs, frequent snow-squalls, numerous icebergs, and some encounters with drift-ice, rendered the work of the ship's officers by no means easy; and the fact that they carried the ship much further south than had been contemplated originally does them the greatest credit. It was very fortunate that we had left Cape Town in November—much earlier in the season than other antarctic expeditions had entered the field—and so had the benefit of the longest days in the highest latitudes. In 60° S. we were able, in spite of the cloudy skies, to see to read on deck at midnight.

Soon after leaving Bouvet island, the wind dropped, and for three weeks its force seldom or never exceeded 7 or 8 of Beaufort's scale. Between 55° and 60° S. the direction of the wind was variable, often blowing light from north or south; the easterly component began to become constant on crossing the sixtieth parallel, and increased in importance towards the south.

The drift-ice limit was reached on November 30 at noon, in 56° 45′ S. At first the ice was made up of small cakes, often drawn out in lines in the direction of the wind; then followed larger and wider fields of drift-ice stretching across the direction of the wind, and gradually assuming the form of pack-ice. A strong ice-blink was often seen, showing that the ice-pack was very extensive to the south. Between the fields of drift-ice, which the ship easily cut through, the sea was as calm as a lake, and we often utilized the opportunity of carrying on our work in the midst of the ice. The edge of the pack was traced from long. 8° E. to 58° E.; although the main pack was not always in sight, as we had occasionally to sail round long narrow tongues of ice, necessitating an east-south-east course. In this way we reached 60° S., but at the 50th meridian found the way blocked by an ice-pack. On December 13 this was got round, and on the following day no trace of ice was in sight, so it was possible to change the course to due south. With a stormy north-east wind, which came on next day, we were surrounded by numerous icebergs, many of which were photographed and their heights ascertained by measurement. Excluding the almost innumerable bergs seen far to the south, 180 were counted, the highest of which was a tabular mass rising to a height of 193 feet above the water. On the evening of December 16 the latitude of 64° S. was reached; the ice was more abundant and stronger than we had previously found it, and increased in thickness towards evening, until at midnight further progress became impossible. We were then in 64° 15′ S. and 54° 20′ E., or only 102 nautical miles from Enderby Land. Innumerable icebergs were in sight to the south, east, and west; one of them measured 10 miles in length, and we took it at first for part of the antarctic ice barrier; a strong ice-blink to the south proved our proximity to the continent, and it is questionable whether some of the high ice-peaks we saw in the far distance may not have belonged to it. At this farthest point a sounding was taken, though with difficulty, as the crew had to keep the line clear from ice by fending the floating masses off with poles, and a depth of 2541 fathoms was found. Hitherto along the edge of the ice the deposit on the bottom of the sea had been pure diatom ooze, but on this occasion it was largely mixed with a clayey substance, a sign of the proximity of land. If the coast of Enderby Land is really in 65° 57′, the sub-oceanic slope must be of a steepness only found in the case of volcanic land.

The great depths encountered since leaving Bouvet island must be looked upon as one of the most surprising results of the expedition. Of the seventeen soundings taken on the southward voyage, no less than eleven showed depths between 2700 and 3300 fathoms, and only one was under 1700 fathoms, in the immediate neighbourhood of Bouvet island. This series of soundings, the first of such completeness in antarctic waters, very greatly modifies our conceptions of the form of the ocean-bed in the far south. Only fifteen soundings had previously been made south of 50° S., the *Valdivia* added twenty-nine, and showed that, instead of being a relatively shallow basin, the Southern ocean is of very great depth. In one respect, indeed, the great depths did not lend themselves to the carrying out of the plans of the expedition. Twelve hours are necessary to make a successful haul of the dredge at depths approaching 3000 fathoms—a very long time in the uncertain weather of these latitudes, where a sudden change might mean loss of gear and danger to life.

On December 16 the barometer was steady at 29·61, with a light easterly wind, and, after a series of hauls with closing tow-nets, the next day was set apart for work with the large trawl. The 17th was one of the calmest and finest days we experienced in the far south. The depth was 2535 fathoms, and from morning to night the steam-winches were hard at work for biological and oceanographical purposes. The large trawl was particularly successful in its working. The dynamometer showed an exceptionally heavy strain on the trawling-cable, but when the net appeared at the surface about 6 p.m., it was found quite uninjured. The load it contained was amazing—immense numbers of stones from the ground-moraine of the antarctic glaciers, and a relatively rich collection of deep-sea organisms. The stones, which had dropped from the melting icebergs, were collected with special care, as they furnish the only evidence as yet available as to the nature of the antarctic continent. They contained specimens of primitive rocks (gneiss, granite, and schist), and besides there was a mass of red sandstone weighing 5 cwt., one side of which, evidently so far as it was embedded in the ooze, was stained blackish. The complete absence of volcanic rocks is evidence that Enderby Land is not of volcanic origin, as the steepness of its submarine slopes seemed to suggest.

One of the great ice-masses seen at the farthest south was examined from boats. It was in parts coloured a reddish brown by earthy layers, which, when melted, yielded a clayey mass with numerous grains of quartz up to the size of a cherry scattered through it. It almost suggested the impression that it resulted from the glacial erosion of such a ferruginous sandstone as we had dredged up.

Amongst the organisms secured at this station there were two large representatives of the remarkable genus of ascidians, Boltenia (*Culeolus*), with stalks no thicker than a knitting-needle and 30 inches long, and many interesting echinoderms, including the sulphur-yellow crinoid (*Hyocrinus*), ophiuroids, and fine species of deep-sea holothurians. There were many small hexactinellidæ and beautiful hydroids in the haul, which was far richer than hauls in similar depths of the Atlantic and Indian oceans.

III. From near Enderby Land by Kerguelen to St. Paul and Amsterdam Islands.

The rest of the cruise in the cold regions was extremely stormy, making work almost impossible. On December 16 the high barometer began to give way, and thick fog came on, which was cleared away by an east-north-east wind during the night, but the sea was so heavy next day that no soundings could be taken. From the 17th to the 22nd of December the storm continued with heavy snow, and strong easterly winds rising sometimes to the force of 10 or 11 on Beaufort's scale. On the 22nd, at 56° S., the wind went round to north, and next day to north-west without cessation of force. The entrance into the west-wind region was accompanied by a very marked fall of the barometer, the barograph went down nearly an inch in twelve hours on the 22nd, and reached the lowest point observed on the cruise—28·54 inches. A heavy swell from the north-west, which began to make itself felt in 61° S., increased steadily in strength, so that it was often necessary to put the ship head to sea, and the rolling was so severe that it was almost impossible to move about the ship. However, as the wind usually fell off after midnight and increased again in the forenoon, it was possible, by taking advantage of the quieter hours, to carry out a series of six soundings between Enderby Land and Kerguelen. The ship was put head to sea on these occasions, and the Sigsbee sounding-machine acted splendidly, the impact of the weight on the bottom being as exactly determined as in calm weather. Only on one occasion was it necessary to stop a sounding after 2700 fathoms had been run out, and the weight was hauled up without having been discharged. The six soundings show that the ocean floor between Enderby Land and Kerguelen is strongly folded, depths of 1300 fathoms alternated with great deeps between 2000 and 3000 fathoms. The shallow plateau uniting Kerguelen with Heard island falls off very steeply, so that two soundings taken on December 24 gave depths of 2145 and 1117 fathoms in the immediate neighbourhood of the rise. It was remarkable how soon the icebergs disappeared on this route; we saw the last, a table-topped giant, 500 yards long, in 61° 22′ S.

Kerguelen came in sight on the first of the Christmas holidays, and as the boilers required to be cleaned out and the engines thoroughly overhauled, we spent three pleasant days in the quiet shelter of Gazelle harbour. It was fine spring weather, the snowy mountains glittered in the sun, in sharp contrast with the green slopes and the dark deep-cut fjords. The members of the expedition were engaged in studying and collecting the plants, and the fresh and salt water fauna of the district, and dredgings were made from the steam-launch in Gazelle harbour and Fairweather harbour, resulting in some new discoveries. Kerguelen appears not to have been visited by whalers or sealers for many years, the birds exhibiting a tameness only to be explained by their ignorance of the ways of man, and the shores in easily accessible places abounded in sea-elephants (*Cystophora proboscidea*), while the provision stores maintained by the French Government were quite untouched. The rabbits landed by earlier expeditions had increased after their kind, and produced a great effect on the vegetation. The Kerguelen cabbage (*Pringlea antiscorbutica*), on which Ross's crews had lived for months, now grows only in inaccessible places and on the small islands.

We left Gazelle harbour on December 30, and took two successful hauls of the dredge in the calm water in the lee of the island. In the afternoon Christmas harbour was visited, and an attempt made in a large rowing-boat to reach the coal-bearing strata; but the swell made it impossible to land on the steep coast to obtain specimens. The return to the anchored ship was a matter of several hours' hard work on account of the sudden squalls which tormented the harbour. Another party, landing on the low shore at the end of the harbour, had more success. Besides sea-elephants, they killed a large male sea-leopard, and brought on board four living examples of the solemn king-penguin.

The *Valdivia* left Christmas harbour in the evening, and at once met a heavy sea with a south-westerly gale. This weather lasted for four days, in the course of which it was possible to take only two soundings, the tremendous swell from the north-west hindering all oceanographical work. On the last day of the year the influence of the Indian ocean on the surface-temperature was observed for the first time. The sea-green colour of the cold water gave place to the deep blue of the warm, and the temperature went up from 39° Fahr. to 49°, and then 53° Fahr. On January 3, when the solitary cone of St. Paul, with its amphitheatre-shaped crater harbour, came in sight, the change in the weather was complete. We entered the calm still waters of the Indian ocean, and with warm sunshine and a quiet sea we could look forward to a period of steady and undisturbed work.

IV. The Oceanographical Results.

In the totally unexplored parts of the Southern ocean, the oceanographical results were necessarily of the first importance, as they furnish a basis for the biological work; and as the expedition had been equipped with all the newest appliances for sounding, temperature, and other physical and chemical work, it

TABLE I.

Table of Soundings by the *Valdivia* in the Southern Ocean.

No. of sounding.	Date.	Latitude S.	Longitude E.	Depth.	Bottom temperature.
	1898.	° ′	° ′	Fathoms.	Degrees Fahr.
56	Nov. 14	36 23	17 38	2280	33·2
57	„ 15	37 31	17 2	2708	32·7
58	„ 17	40 31	15 7	1417	35·2
59	„ 17	41 5	14 52	2860	33·2
60	„ 18	42 18	14 1	2512	32·7
61	„ 19	43 52	13 6	2962	32·7
62	„ 20	46 2	11 35	2618	32·7
63	„ 22	49 8	8 41	2415	32·7
64	„ 23	50 57	7 40	1960	—
65	„ 24	53 31	6 14	1240	33·0
66	„ 25	54 22	4 37	1891	32·0
67	„ 25	54 29	3 43	310	—
68	„ 26	54 30	3 31	240	33·8
69	„ 27	53 49	3 57	1011	32·7
70	„ 27	53 52	4 6	1270	32·4
71	„ 28	54 29	3 30	250	34·0
72	„ 29	55 21	5 16	1684	31·5
73	„ 30	56 29	7 25	2758	—
74	Dec. 1	56 16	10 53	3018	31·2
75	„ 2	56 30	14 29	2784	—
76	„ 4	55 26	18 2	2236	31·6
77	„ 5	54 54	22 13	2207	(32·8)
78	„ 6	54 46	26 40	2517	31·5
79	„ 7	55 27	28 59	3025	31·4
80	„ 8	56 44	32 6	3010	31·4
81	„ 9	58 5	35 54	3134*	31·4
82	„ 10	59 16	40 14	2980	31·5
83	„ 11	58 53	43 1	2965	—
84	„ 12	59 1	47 38	3009	32·2
85	„ 13	60 11	49 48	3042	31·6
86	„ 15	62 27	53 22	2829	31·6
87	„ 16	64 9	53 12	2540	31·4
88	„ 17	63 17	57 51	2534	31·2
89	„ 18	63 32	58 40	1504†	—
90	„ 19	61 45	61 16	1940	31·8
91	„ 21	58 55	64 49	2527	31·6
92	„ 22	56 19	66 48	1306	34·0
93	„ 23	54 33	67 52	2690†	—
94	„ 24	52 48	69 13	2145	32·5
95	„ 24	51 50	69 48	1102	35·0
	1899.				
96	Jan. 1	43 45	75 34	1878	34·5
97	„ 2	41 6	76 24	1801	34·5
98	„ 3	38 41	77 36	86	55·0
99	„ 3	38 40	77 39	367	49·8
100	„ 4	37 45	77 34	800	37·8
101	„ 4	37 47	77 34	271	51·0

* Deepest sounding in antarctic area.
† No bottom; sounding incomplete.

was confidently hoped that the observations would give a strong impetus to antarctic research. The ice-conditions were more favourable than could have been foreseen, and we were thus able to push much further south than we had expected.

1. *Soundings.* We used by preference the Sigsbee sounding-machine lent by the German Admiralty, and found it admirable for the rapidity of its working and the distinctness with which the shock of the lead on the bottom could be felt. The Le Blanc machine was also occasionally employed when the drum of the Sigsbee machine required to be strengthened. Our proficiency in sounding may be judged from the fact that in the seventy soundings made between Capetown and Padang, not a yard of sounding-wire was lost. The only loss that took place was due to the breaking, on two occasions, after the sounding had been completed, of the hemp-served "forerunner," to which the sounding-rod is attached. The first time the accident was due to a strong wind, the second time to the rusting of the wire in a place which was not easily accessible. Compared with the experience of the cable-ships, this shows a remarkably small loss of gear. Our immunity was in no small degree due to the splendid manœuvring of the ship in stormy weather.

2. *Temperature and Chemical Conditions.* Negretti and Zambra's reversing thermometer has given good results since the vanes of the screw-propellor which liberates the instrument have been reduced to half their former size. These thermometers were indispensable in the antarctic regions, because of the heterothermic condition of the water, and on this trip they were used for the first time (except in an almost incidental manner on the *Balæna* in 1892) with good result in the antarctic. Siemens' electric thermometer, although not out of the experimental stage, showed that in favourable circumstances it could give a degree of exactitude scarcely attainable with any other apparatus.

Between Capetown and Padang eighteen serial temperature soundings were taken, of which the figures of three are given in Table II. The first of the three shows the vertical distribution of warmth in the temperate zone, the second in the frigid zone, and the third in the tropics. The most interesting from the biological as well as the oceanographical point of view is that taken on the edge of the southern ice. The importance of a sheet of comparatively warm water nearly 1000 fathoms thick lying under the icy water of the surface-layers is so apparent that it need only be mentioned. For instance, the lower parts of the large icebergs must enter the warm water, and so be subject to rapid melting even in the antarctic regions. In the west, near Bouvet island, we found the temperature of the water fairly uniform throughout, although on the whole somewhat lower. The higher salinity of the warm layer makes it clear that this distribution of temperature may remain permanent in the absence of vertical currents which would effect a mixture.

In the section through the south-east trade-wind region of the Indian ocean, the *Sprungschicht*, or zone of rapid change of temperature, occurs at depths between 100 and 150 fathoms, so that the great surface-heating of the water in the tropical zone is a very superficial matter indeed, at least for temperatures above 70° Fahr. At 250 fathoms the similarity with the temperature of the temperate zone is almost complete.

On the chemical investigations the chemist of the expedition makes the following observations:—

"With few exceptions, the water samples from great depths were collected by means of Prof. Pettersson's isolating water-bottle, and for the upper layers by means of Meyer's water-bottle closed by means of a messenger dropped down the line, while the surface samples were collected directly. A portion of the sample when obtained was examined in the laboratory on board at once, in its fresh condition,

TABLE II.

Typical Temperature Series.

Depth. Metres.	Depth. Fathoms.	Station 116. Nov. 14, '98. 37° S., 18° E.	Combined Stations 149, 152, and 153. December 16 to 18, 1898. About 63° S., 54° E.				Stations 179 and 180. Jan. 16 and 17, '98. 14° S., 90° E.
		Temp. F.	Temp. F.	Salinity per cent.	Oxygen.	Carbonic acid.	Temp. F.
		°	°		c.c.	Grammes.	°
0	0	60·1	30·2	33·7	8·04	0·0520	81·4
10	5½		30·0				
20	11		29·8		7·93	0·0521	
40	22		29·8				
50	27		29·6		7·98	0·0523	80·8
60	33		29·6				
80	44		29·0		6·81	0·0539	
100	54½	58·4	30·0		5·44	0·0545	77·2
110	60		31·2				
120	65½		31·4		5·19	0·0533	
130	71		33·0				
140	76½		33·2				
150	82		33·2	34·0	4·81	0·0541	
200	109½		34·6				69·4
250	136½	56·2	—				
300	164		35·0		4·14	0·0544	55·8
400	219		34·8	34·4	4·34	0·0545	
500	273	49·2	—				48·6
600	328		34·2				
800	437		34·7				44·0
1000	547	40·4	34·9	34·5			41·8
1500	820	36·8	34·9	34·6	4·33	0·0576	39·4
2000	1094		33·0				
2750	1504		31·4				
Total depth.		4170 mt. 2280 fms.	4600 mt. 2515 fms.				5834 met. 3190 fms.
Bottom temp. F.°		33·2	31·2				34·4

to determine its contents of dissolved oxygen and carbonic acid, and the rest was secured in bottles for more complete investigation ashore. The amount of dissolved oxygen was determined by Winkler's titrimetric method, which gave good results on both the *Pola* and *Taurus* expeditions. It consists in adding to a measured quantity of sea water an alkaline solution of potassium iodide and manganese chloride in the absence of air; the dissolved oxygen forms manganese oxide, and the chlorine liberates an amount of iodine equivalent to the oxygen absorbed. The iodine is easily estimated by a standard solution of sodium thiosulphate, using starch as an indicator. The total combined carbonic acid was estimated by means of a solution of hydrochloric acid."

3. *Biological Investigations in the Cold Region.* It would far exceed the scope of this report to discuss the biological results of the expedition, but it may be stated generally that special attention was given throughout to the study of plankton, or the organisms floating in the water. Our vertical tow-nets were sunk in the great depths to as much as 1600 fathoms, and often brought up a surprising amount of material. Many of the forms obtained from the cold deep layers in the tropics were found again in water of similar temperature at the farthest south. In general, it may be said that, while the number of forms in the antarctic regions falls short of that in the warmer zones, the abundance of life there is surprising.

Special stress must be laid on the value of the results secured by the closing tow-nets. It may be said that from the surface to 1000 fathoms the number of floating organisms is very considerable, and then rapidly diminishes to the bottom. Yet in one of the tow-nets worked between the depths of 2700 and 2400 fathoms (in 59° S.) we found four genera of living copepods and numerous active larvæ, a living ostracod, and several radiolarians. Many empty or dead shells of globigerina, radiolarians, and pteropods, were also found. It can now be positively asserted that no parts of the ocean depths are devoid of life; but some organisms prefer the superficial and some the deeper layers. Thus, amongst radiolarians, the Challengeridæ abound most between 20 and 150 fathoms, while the Tuscaroridæ were never found nearer the surface than 500 fathoms.

The plankton of the Antarctic ocean was found to be characterized by a great abundance of diatoms, including many peculiar to the locality, and leading to the predominance of diatom ooze as a deep-sea deposit. The northern limit of the diatom region was crossed by the expedition in the Atlantic and Indian oceans at about 40° S., and corresponded with a sudden fall of temperature. As far as 50° S. forms characteristic of warmer regions still occurred, but they disappeared further south. The flagellates were much inferior to the diatoms in number in the antartic area, but a new peridinium (*P. antarcticum*, Schup.) was found, and by its easy identification it formed one of the best indicators of the purely antarctic plankton. As such vegetable organisms as diatoms are dependent for their existence on the access of light, an attempt was made, by determining their lower limits in the ocean, to fix the depth to which sunlight penetrates in sea water. This was found to be between 150 and 200 fathoms, but very little vegetable life was found below 50 fathoms. Empty cases were found abundantly at greater depths, but these were evidently the remains of dead specimens which had fallen from above. The maximum abundance of plankton vegetation seemed to be in about 40 fathoms.

THE BELGIAN ANTARCTIC EXPEDITION.

The Royal Belgian Geographical Society of Brussels has issued in advance of its *Bulletin* a letter received from Captain Gerlache, dated from Punta Arenas in Magellan strait on April 1, 1899, which, on account of the important bearing on the question of Antarctic exploration, we translate in full without comment of any kind.

The *Belgica* left Punta Arenas on December 14, 1897, and, proceeding by the Cockburn and Beagle channels, called at the Argentine coaling station of Lapataïa in Tierra del Fuego, where, by the kindness of the Argentine Government, the vessel filled up with coal. The *Belgica* anchored every night in navigating these intricate waters, and the scientific staff took every opportunity of studying the fauna, flora, and geology of the land.

On January 1, 1898, the *Belgica* left the port of Hushuaïa near Lapataïa with the intention of gaining the open sea to the eastward, and staying for the night at Haberton, where a retired English missionary has established a farm and a warehouse. But darkness set in before the bay was reached, and the *Belgica* ran on a submerged rock and remained fast till the next day. This incident had no more serious consequence than the loss of all the fresh water, which had to be pumped out to lighten the ship, and it was necessary to put into the Bay of St. John on Staten island to replenish the supply. It was only on January 14 that it was possible to leave this anchorage and make for the South Shetlands. On the way seven soundings and several temperature observations at various depths were taken. The deepest sounding was made on January 15, in 55° 50′ S. and 63° 19′ W., when the depth was 2209 fathoms.

On the 21st, land was sighted during a clear interval in thick weather; on entering Bransfield strait the weather continued foggy while the wind freshened, and on the 22nd it blew a gale from the north-east. In attempting to open a scupper, the sailor Wiencke from Christiania, who had been imprudent enough to sling himself over the side, was carried away by a wave, and all efforts to save him were in vain. A few minutes afterwards Low island was sighted to leeward, and we proceeded to the west of it for shelter. On the 23rd the weather improved; the *Belgica* proceeded to Hughes bay, and on the 24th discovered a strait separating an important archipelago (which we provisionally called Palmer archipelago) from the land to the east.

During the three weeks which followed, the expedition made a rapid survey of Hughes bay and the new strait, landing wherever it was more or less practicable. Twenty landings were made altogether between Bransfield strait and the Pacific, both on the eastern part of the islands of the archipelago and on the eastern mainland, which we subsequently called Danco Land, and the natural history collections were enriched. M. Lecointe determined the co-ordinates of the prominent points, and M. Danco determined the magnetic elements wherever it was possible to land the instruments. M. Racovitza discovered and collected one species of Podura, one species of Diptera, and several species of minute Acarides, representatives of an antarctic fauna hitherto quite unknown. He also collected specimens of mosses, lichens, and grasses, and made observations on penguins, cormorants, and many other species of birds which frequented these lands. M. Arçtowski did not lose any opportunity of collecting specimens of rocks which should furnish data regarding the geological character of the island, while Dr. Cook was equally diligent in securing photographs which should prove of real value apart altogether from their artistic excellence.

The *Belgica* entered the Pacific ocean on February 12, and steered for Alexander I. Land, meeting with pretty thick fog until the 16th, so that Biscoe islands were not visible. On the 16th the weather was fine and clear, and Alexander I. Land was in sight, as well as some land in the east, which might be Graham Land or Adelaide island. The course was continued to the westward to explore the edge of the ice-pack, and on February 28 the ship had reached 70° 20′ S. and 85° W. A gale was blowing from east-north-east, and great gaps were made in the edge of the ice. Although the season was very far advanced, the occasion seemed propitious to push southward and gain a part of the antarctic area which was still quite unexplored. The risk of an enforced wintering was obvious, but on the other hand there was the chance of attaining a high latitude, and if she was unable to regain the open sea, the ship would possibly at least winter in the neighbourhood of new land. On entering the pack the *Belgica* reached a position of 71° 31′ S. in 85° 16′ W. without too much difficulty. On March 3 it was absolutely impossible to go farther, and the ship was put about, and during that day and the week following made from 7 to 8 miles towards the north in a very solid pack. On March 10 she was finally blocked; the pans of ice floating round the vessel froze together and soon formed an immense field of ice. At this time the *Belgica* was about 60 or 70 miles from the edge of the pack, and arrangements were made for wintering. The ship was banked up with snow to the height of the deck to reduce the loss of heat by radiation, and the deck was roofed over. She remained thus under pressure till March 26, with some prospect of the ice breaking up. During the later part of the month the cold became intense with southerly winds. The temperature depended entirely on the direction of the wind. When it came from the south, the weather was clear and cold; when from the north, *i.e.* from the open sea, it was almost always cloudy, often foggy, and the temperature kept near the freezing-point, sometimes even causing a thaw. The drift of the ship was also a direct function of the wind. During the drift the latitude of 71° 34′ S. was reached in 89° 10′ W. on May 16, and 71° 36′ in 87° 39′ W. on May 30.

The appearance of the pack changed constantly with the movements to which it was subject. Generally it was very compact, but great openings sometimes appeared, clear spaces, channels, or mere threads of water. The cracks the formation of which gave rise to these lanes of water often extended beyond the reach of vision to the north or south, the east or west, and they were often formed quite near the ship, which, gripped in its icy vice, was unable to reach them. The openings soon closed up, either by freezing over if it was calm, or else by pressure; and in the latter case a row of hummocks rose up on the line of contact. There was a good deal of wind during the winter, and violent snow-showers often made all outside work impossible. It was equally impossible to make any extended journey on the ice on account of the mobility of the pack and the frequent occurrence of strong wind. The sun set on May 17, not to rise again until July 21.

Lieutenant Danco fell ill at the beginning of May, and, in spite of the assiduous attention of the surgeon, he grew worse daily, although happily the brave fellow did not realize the seriousness of the case. On June 5, at 7 p.m., he quietly expired, surrounded by his sorrowing comrades, all of them his friends. On the 7th, at noon, the body was committed to the deep through an opening cut in the ice. The weather was cold and miserable, and everything combined to make this sad ceremony the most melancholy that could be imagined.

Although seals and penguins were never numerous in the immediate neighbourhood of the ship, they formed a considerable portion of our food-supply during the later months of the wintering; and this supply of fresh meat contributed not a little to keep up the health of the ship's company, which remained excellent except during the critical period of the polar night, when cardiac affections gave some trouble.

In the month of October the cracks, channels, and open spaces became more numerous, although on some days the pack was discouragingly tight, and round the ship for the space of a mile in radius it remained solid. The ship was from 700 to 800 yards from the edge of a great floe, about two miles in diameter, round which cracks were often formed. On the edge nearest the ship, about 600 yards away, a large open space had formed at the beginning of October, and did not close, except partially and temporarily, on account of pressures. These pressures led to the formation of cracks on the edge of the floe, which gradually encroached upon it. Meanwhile, summer was rapidly advancing, yet on certain days, when the wind was in the south, the temperature fell sufficiently for young ice to form, and a second wintering appeared imminent. At the beginning of January, 1899, it was resolved to saw out a canal in the ice to the large open space. For the greater part of its length (which was 800 yards), this canal took advantage of a lane which had been closed by freezing over in May, and thus consisted of comparatively thin ice. Measurements made by the Van den Broeck borer showed an average thickness of ice a little over 3 feet to be cut through, but the older ice near the ship was nearly 7 feet thick. As it was necessary not only to saw the ice through in two longitudinal lines, but along many transverse lines, so as to cut it into blocks which could be hauled out into the clear space, the total length of sawing amounted to about 3000 yards, and this work occupied all hands for three weeks. By February 1, 1899, it only remained to saw through and blow up with tonite the blocks of ice nearest the ship; but then a pressure occurred, the newly cut canal was narrowed, and the clear space to which it led closed up, and it seemed impossible to get free. But fortunately at the beginning of February the slight movement of an ocean swell under the ice became perceptible, and it was plain that we were much nearer the edge of the pack than at the beginning of winter. On February 11 there was a great crack, and from the crow's nest the clear space could be seen extending to the northern horizon; our canal opened a little also, but not enough to let us get out. The swell became more and more perceptible, and we set to work to clear the canal of young ice and the semi-solid mixture of ice and snow. On February 13 we were able to start the propeller for a few turns, and on the 14th, at 2 a.m., we were able at last to leave our winter quarters. During that day and the next we made 15 or 16 miles towards the north; there was no more question of going southward. On the evening of the 15th we were again blocked; the pack, much broken up by the swell, was still so close and compact that we were scarcely able to move the ship a little out of the way of some icebergs whose neighbourhood might be dangerous.

Meanwhile the sky was very dull to the north, a certain sign of the existence of a great expanse of clear water in that direction, perhaps the open sea. Every day the swell became stronger, and it was evident that we were not very far from the edge, and at last, on February 20, from the crow's nest we could see under the "water-sky" a long black line, extending along the horizon from east to west; it was the open sea, not more than 7 or 8 miles to the north, but the pack remained solid, though heaving on the swell.

Throughout the whole winter the *Belgica* was only once subjected to severe pressure, and the vessel seemed in real danger only for a few minutes; but now constantly struck by great blocks swinging with the swell, our little vessel was in a very uncomfortable position. Thus it was an immense satisfaction to every one when, on March 14, at 2 a.m.—a fateful date this 14th—the pack opened sufficiently to allow us to steam out and gain the open sea.

During the second period of our detention in the pack the winds were almost always easterly, and the drift was considerable to the west. We emerged at 103° W., so that the general drift was 18° to the west in a mean latitude of 70° 30′. We saw no sign of the "appearance of land" shown on the charts in 70° S. and 100° W. It may be remarked also that with northerly winds we drifted to the south just as freely as we drifted to the north with southerly winds, while the soundings which we took throughout the drift whenever the weather gave us an opportunity, indicate that the hypothetical outline of the antarctic continent must be carried several degrees further south in that part of the antarctic zone. Throughout the winter—the first ever spent in the antarctic ice—we were able to carry on good magnetic observations, to make an important series of hourly meteorological observations, and to make a fine collection of pelagic and deep-sea organisms and of deep-sea deposits.

It was on March 14 that we escaped from the clutches of the ice, and at noon on that day we had gained the open sea. On the 16th, at 4 p.m., we recognized Black island, and at 6 p.m. anchored in its lee to shelter from a strong west wind. From the edge of the pack to Tierra del Fuego we had not encountered a single piece of ice, a fact which is at least worth mentioning. During the night of the 26th there were heavy squalls, and at 5 a.m. on the 27th, the wind blew a gale from east-south-east, and the anchor began to drag and we had to cut the cable and stand out to sea to save the vessel from driving on the rocks. At 9 a.m., while the gale was still raging, we entered Cockburn channel and reached the anchorage of Punta Arenas next morning at daybreak, fourteen days after leaving the pack.

N.B.—The commander and the members of the expedition, being much absorbed in their professional duties, beg their personal friends in particular, and the friends of the expedition in general, to excuse them for not having written, and beg of them above all not to attribute this to forgetfulness, to negligence, or to indifference.

The expedition was to leave Punta Arenas for Buenos Aires, where and at Rio de Janeiro it would sojourn for some time, reaching Europe about the middle of August.

THE MONTHLY RECORD.

THE SOCIETY.

Awards of the Society for 1899.—The Royal Medals and other awards have been adjudged this year as follows: The Founder's Medal to Captain Binger, for the valuable work which he did during his extensive journeys in the country within the great bend of the Niger. The Patron's Medal to M. Foureau, for his continuous exploration in the Sahara during the last twelve years. The Murchison Grant has been awarded to Lieut. Albert Armitage, for his valuable scientific observations with Mr. Jackson in Franz Josef Land; the Gill Memorial to the Hon. David Carnegie, for his journey across the West Australian Desert; the Cuthbert Peek Grant to Dr. Nathorst, for his important scientific exploration of the Spitsbergen Islands; the Back Grant to Captain Molesworth Sykes, for his three journeys in Persia.

EUROPE.

The Fish-fauna of the Kaiser-Wilhelm Canal.—The experimental fishery which has been carried on by Fishery-Inspector Hinkelmann since the opening of the Kaiser-Wilhelm canal, has supplied valuable information on various questions, both scientific and practical, connected with the movement of salt and fresh water forms and the possibility of their adaptation to altered conditions of life. The results of Herr Hinkelmann's visits of inspection during 1898 are briefly summarized in a recent number of *Die Natur* (February 26, 1899). One of the most important questions awaiting solution is that of the possibility of the canal affording fresh spawning-grounds for herring; and though this has not yet been fully answered, it is already possible to say that the prospects at least of favourable spawning-grounds in the future are good. Both herrings and sprats were met with in considerable numbers and of all sizes, but the spawn has not yet been found *in situ*, and for this object it will be necessary to commence the experimental fishing earlier in the year in future. The good effects of the canal on the fishery in the Kiel inlet are dwelt upon, and it is said that both herrings and sprats were caught in shoals off the canal-mouth during the autumn. The inspection was last year limited to the eastern part of the canal, between Holtenau and Rendsburg, and here it was ascertained that a constantly increasing immigration of Baltic forms is taking place, the increase being observable both as regards species and individuals. It also appears that, after an apparent falling back before the salt-water element, the fresh-water species have begun to show a remarkable power of adaptation to the new conditions. Ten different species are enumerated as occurring in the brackish water of the canal, and all were found to be in good condition. This was especially the case with the pike, which, immediately after the opening of the canal, were reported as having been blinded by the sudden access of salt water. Eels were particularly numerous in the Flemhuder See, the water of which, in spite of the large volume poured in by the Eider, shows a comparatively high percentage of salt. The banks of the canal show a luxuriant growth of plants in many places—a fact favourable to the existence of organisms which form an important source of food-supply to the fish. This applies especially in the case of the Baltic prawn—a fact the more remarkable as the species has of late years become much scarcer than formerly on the Baltic coasts of Germany.

The Snow-line in the Balkans during the Glacial Epoch.—We referred in our April number to Dr. Cvijić's explorations in the Rila mountains, and his estimate of the former snow-level in that range. We have since received details respecting further investigations by the same geologist into the question of the glacial snow-level in the Balkan peninsula generally, carried out during journeys continued down to the summer of 1898. His conclusions are as follows: In the limestone ranges of Central Bosnia, south-west of Sarajevo (6400 to 7300 feet in altitude), the snow-line can be drawn for the Glacial epoch at a height of 5600 feet, and therefore agrees with the corresponding line in the Western Alps of Transilvania (6000–8300 feet in height), which lie far to the north-east of the former mountains, on the borders of Hungary and Rumania. As we advance further into the peninsula, we find a gradual rise in the level of the glacial snow-line, and this in a direction from north-west to south-east in the parts adjacent to the Adriatic, but more directly from north to south in the more central parts. These facts are clearly brought out by the lines of equal altitude of the snow limit, drawn at intervals of 100 metres, which, broadly speaking, all form curves concave to the south-south-east. The difference between the altitude of the glacial snow-level in the north of the peninsula and that on the Peristeri and Nice mountains in the south-west, or in the Pirin (not Perim) Dagh in Central Macedonia, amounts to fully 1600 feet; that is to say, the snow-line in the latter mountains, with a height of 8300 to 8800 feet, ran during the Glacial epoch at a height of 7200 feet.

The Geographical Causes of Spain's Downfall.—Prof. Julius Maerker, of Constance, contributes to the *Geographische Zeitschrift* (1899, No. 4) an instructive paper on the causes of Spain's downfall, tracing the influence which has been exerted, throughout the whole history of that country, by geographical and climatic factors. At the outset he combats the idea that some peoples are naturally more gifted than others, and therefore more capable of high development, holding that the mental characteristics of races have been evolved mainly by the influence of their environment. While the geographical conditions of Europe as a whole are peculiarly favourable, Spain stands apart from all the other countries of the continent in the form and nature of its surface. In spite of its apparently favourable position, surrounded by the sea, the main bulk of the peninsula is in reality completely shut out from the life of the world; and the pride and exclusiveness engendered among its inhabitants by this state of things has formed a potent bar to progress. Its massive central plateau, almost without navigable rivers, is shut in both on the north and south by ranges of mountains broken by few passes, and is itself traversed by chains which form an additional barrier to intercourse. Until the beginning of the modern era, Spain lay on the margin of the civilised world, and was not fitted by position to play the *rôle* of an intermediary between North-Western Europe and the states of the Mediterranean. It may then be asked, How were the Spaniards able to take the part they did in the age of discovery? Led on by the example of the Portuguese, who in two hundred years had been trained to the sea by skilled Italians, they found the necessary instruments in the seafaring population of the north-west, whose strip of coast was, however, too scanty to allow them to play independently a leading part in the world's commerce.

The rush to America, and the ease with which wealth was there acquired, depopulated the country and discouraged habits of industry, while even as regards her sphere of action in the New World, Spain was at a disadvantage, for her position on the map, in relation to the course of the trade winds and the equatorial current, brought her in touch only with the enervating regions of the tropics. Dr. Maerker dwells on the disadvantages arising from the absence of fertile lowlands and navigable rivers, in which respects Spain presents a marked contrast to England. Her mineral wealth alone presents a more favourable picture. In conclusion, the climatic disabilities of the great bulk of the country are pointed out, the more favourably situated portions in the north-west and along the Mediterranean shores occupying a comparatively small area.

The Lakes of the Pyrenees.—A note in the second number of the *Geographische Zeitschrift* announces the sounding, in August last, by Messrs. Ritter and Delebecque, of twenty-two of the high-level lakes of the Pyrenees, which had never before been thoroughly examined. Except two, which present the character of Karst lakes, and are due to a landslip, all are regarded as glacial in origin. The deepest of those examined was the Lac de Louey-Négré (112 feet), one of a group of four in the neighbourhood of Barèges, in the Hautes-Pyrénées. Its water is remarkably transparent. Eleven lie in the *massif* of Mount Carlitte, in the Eastern Pyrenees, and of these two, the Lac de Pradeilles and the Lac de las Dongues, are remarkable for discharging in two directions, to the Tet and the Segre.

Seiches in the Lake of Gmunden.—Karl Schulz, of Gmunden, announces in *Globus* (vol. lxxv. p. 216) that he has succeeded in proving the occurrence of regular changes of level, or "seiches," in the lake of Gmunden. The variations were observed both with the naked eye and by means of a limnograph set up near the exit of the Traun from the lake. They occur even when, to all appearance, the lake is absolutely motionless, and their extent ranges from a few millimetres to 12 centimetres (4·9 inches). On the average five occur within the hour.

ASIA.

Captain Deasy's Explorations.—Writing from Kashgar, on March 7, Captain Deasy recurs to the question of the source of the Khotan river, which, as recorded in our January number, he succeeded in discovering last summer. We then remarked on the proximity of the sources of the Khotan and Keria rivers which would result from Captain Deasy's position of the former; and on this account it was suggested by Colonel H. Trotter (*ante*, p. 448) that Captain Deasy had possibly mistaken the headwaters of the Keria for those of the Khotan river. Captain Deasy's additional statements show that this was not the case, but that the two rivers rise on opposite sides of the same high and extensive snow range, the sources of the Khotan daria lying to the north, and those of the Keria daria to the south. He states that he camped and observed close to the most northerly source of the former. Captain Deasy had been travelling most of the winter, and had therefore been unable to send us a detailed account of his journey to Northern Tibet and the Aksai Chin, but hopes to do so at an early date. He alludes to the extensive manufactory of so-called ancient manuscripts at Khotan, and warns travellers to be cautious in their purchases, fully 95 per cent. of the relics offered for sale being probably spurious. Genuine books of ancient date no doubt exist, but are exceedingly difficult to procure. Captain Deasy also alludes to the rapid extension of Russian influence in Tibet, which threatens, he says, soon to become complete.

Captain Sykes' Journeys in Persia.—Captain P. Molesworth Sykes, whose earlier journeys in Persia were described to the Society in 1897, writes to us from Sistan, under date February 6 last, giving an account of his travels in that country during the past winter. In August he had left Shiraz on a mission to Luristan, but subsequently received orders to establish a consulate in Sistan. From Isfahan to Kerman he travelled over old ground, as he was accompanied by an official of the Indo-European Telegraph Department, for whose purposes a fixed route was necessary. From Rigau, however, the chief town of Narmshir, he struck across the hitherto unexplored desert to Kwash, the capital of Sarhad, experiencing much difficulty in the matter of water-supply. The whole country was suffering from drought, so that the supply question generally was a constant anxiety. From Kwash, Captain Sykes and his party skirted the great volcano of Taftan, and made an attempt to scale it; but just near the summit the way was blocked by cliffs. At about 12,000 feet, seven orifices, emitting a sulphurous vapour with considerable noise, were discovered. Beyond Ladis, the Quetta-Sistan trade-route, now being opened up by the Indian Government, was struck, and a march of 100 miles across the desert from Kuh-i-Malik-Siah brought the party to Sistan. Captain Sykes draws a parallel between the two provinces of Sarhad and Sistan, relatively to each other, on the one hand, and Palestine and Egypt on the other; Sarhad being in many ways the counterpart of Palestine, while it is separated by a desert tract from Sistan, the only district in Persia that need not fear a drought. The conditions at the time of his visit were similar to those in Palestine and Egypt in the time of Jacob and his sons. In Sistan Captain Sykes had met Mr. Tate, who, after fixing the position of the Kuh-i-Khoja, the only hill in the country, and other points, handed over to him Asgar Ali, an excellent native surveyor. A correct map of Sistan, the first of its kind, may be expected to result from his labours.

The Botany of the Northern Kachin Hills.—Lieut. Pottinger's journey through the mountainous region north-east of Myitkyina, though less fruitful of geographical results than could have been wished by reason of the unfortunate attack on his party, has done good service in the interests of our botanical knowledge of the region, which, from its position on the map, possesses an unusual interest in this respect. The main results, with especial reference to the relationships of the flora to that of neighbouring regions, are summarized in vol. i. No. 11 of the 'Records of the Botanical Survey of India,' by Lieut. Pottinger and Mr. D. Prain, keeper of the Calcutta Herbarium, conjointly. The former also gives some interesting general information respecting the country visited. The route followed led up the valley of the Nmai-kha, or eastern branch of the upper Irawadi. The mountainous country (in which frosts occur in the cold weather) was reached at Namlao, a little east of Myitkyina, and was found to be intersected by rapid streams flowing to the Nmai-kha. North of the Chipwi-kha, one of these tributaries, the slopes become steeper, and only the river valleys are inhabited, the higher hills being clothed with virgin forests. Two ranges, of 12,000 and 9000 feet respectively, were crossed, vegetation being more luxuriant on the southern than on the northern slopes. Large fir-trees grow on the upper parts, but no pines. Elsewhere pines (apparently *Pinus Khasya*) were common east of a range which runs more or less north and south in about 98° 33′ E., while west of it only occasional specimens occurred; on the other hand, no large bamboos were seen east of the same line. According to a route-map which accompanies the report, the turning-point was in 26¾° N., just below the junction of the Meh-kha with the Nmai-kha. Snowy peaks are marked on both sides of the latter above this point, and also east of the Irawadi in about 26° 18′ N. The staple crop throughout the hills is rice, wet cultivation, however, being hardly seen, except during the early part of the journey. Lieut. Pottinger considers that the "jhum" system of cultivation, by which fresh patches of forest are constantly burnt, is due to the encroachment of forest grasses and weeds after the first season. Tea is indigenous, and is occasionally cultivated in small quantities. The list of plants collected, which includes the names of specimens obtained by a native collector with the help of Lieut. Cruddas after the date of the journey, embraces 627 species. Mr. Prain, in discussing the relationships of the flora, shows that the catchment area of the upper Irawadi, including the Hukung and Taping valleys, admits of being treated as a phytogeographical entity, the relationship of which to the neighbouring sub-sub-areas of China, Indo-China, and the Eastern Himalaya is a point of great interest. A careful examination of the distribution of the Kachin species brings out the meagreness of the Chinese element, and generally the predominance of Western over Eastern influences. While presenting marked affinities both with the Himalayan and Assam-Aracan floras, the Kachin flora must, from the present data, be considered as most closely related to the latter, which the writer has elsewhere shown to merit the rank of a separate sub-sub-area.

Russian Expeditions in Central Asia.—The report of the Russian Geographical Society on the work performed in 1898, which was read at the annual meeting in February last, contains some details on the expedition carried out by M. Klementz to Tungaria and Chinese Turkestan. The objects of the expedition were mainly archæological, but it resulted in additions to our knowledge of parts of the Altai and Western Gobi, while extensive meteorological observations and a zoological and botanical collection were made. The antiquarian discoveries are of much importance. Ruins of ancient cities were examined in the neighbourhood of Turfan, Khara-Khodka, Toek-Mazar, and elsewhere; but the most striking discovery was that of Buddhist cave-temples, containing well-preserved frescoes, together with ancient manuscripts and inscriptions in the Uigur language, Chinese, Sanskrit, etc. A part of the frescoes and inscriptions were brought away, and others were photographed. In all no fewer than one hundred and thirty of these cave-temples were examined. An attempt to bring home a living specimen of the *Equus Prjevalskii* was unsuccessful, as none of the four foals caught survived the journey. Another expedition alluded to is that of V. F. Novitzki, who, after a journey in India, returned through Ladak, the Karakoram, Raskem, and Kashgaria to Osh. He is said to have crossed the Raskem range by a difficult pass, never before traversed by a European, nearly losing all his baggage in the attempt. From *Globus* (vol. lxxv. p. 216) we learn that in March last D. N. Golovin gave an account, before the Russian Geographical Society, of his journey to the Pamirs during the summer of 1898. His route led from Osh across the Alai range, and by the lakes Kara-kul and Rang-kul to the Murgab. Extensive meteorological observations and barometrical determinations of heights were made throughout. Lastly, it is announced in the *Verhandlungen* of the Berlin Geographical Society that a new expedition, equipped for two years' work, is being sent from St. Petersburg under the command of Lieut. Kozlof. It will cross the Gobi and make its way over the Nan-shan range to the upper course of the Hwang Ho.

Bogdanovich's Expedition in Eastern Siberia.—We learn from *Globus* (vol. lxxv. p. 216) that the Russian traveller Bogdanovich, leader of the expedition to Okhotsk and Kamchatka (*Journal*, vol. xi. p. 175), returned to St. Petersburg in February last. He had examined the whole coast from Nikolaievsk, on the Amur, to Petropaulovsk in Kamchatka, travelling both by summer and winter, amid physical difficulties of all kinds, in temperatures reaching as low as −58° Fahr. One of the most important results of the journey has been the discovery of a new gold-producing region of immense extent and easily accessible. After the completion of the expedition in August last, the leader proceeded to the Liau-tung peninsula in order to investigate the occurrence of gold there, and was able fully to confirm the reports that had been spread as to its wealth in this respect, finding not only abundance of gold-bearing sand, but even gold in veins.

AFRICA.

Major Marchand's Journey across Africa.—By his arrival at Jibuti in the middle of May, Major Marchand has completed one of the most notable journeys across the African continent which have been made within recent years. The route followed led through much difficult country and across almost the widest part of the continent, while the extensive equipment due to the military nature of the expedition involved difficulties which a smaller party would have escaped. That the geographical results have not been greater was unavoidable under the circumstances. The final section of the route, from Fashoda to the Gulf of Aden, would a year or two ago have led through much new ground, but the recent exploration of the Sobat and its branches by Bòttego and De Bonchamps left few important discoveries to be made in this region. To Marchand and his companions, however, remains the honour of being the first to open a continuous route from the Nile to the ocean in the given latitude. The Sobat was ascended by means of the gunboat *Faidherbe*, and the smaller steel and aluminium boats, but its navigation involved great difficulties, especially at the Baro rapids. The upper course of the Baro was not completely explored by De Bonchamps, so that it is possible that some new work was done here. Beyond the Baro, however, the last-named traveller's route seems to have been followed, as the expedition journeyed *viâ* Bure and Gore, at the former of which places a member of the Bonchamps mission was found. Leaving Gore on February 13, Major Marchand reached Addis Abeba on March 10, his journey being facilitated by the Abyssinian authorities.

Report on the British East Africa Protectorate.—In spite of many draw backs to which British East Africa was subject during the year 1897–98, Sir A. Hardinge, in his lately issued report for that year, is able to announce that satisfactory progress was made towards the development of the territory during the third year of its existence as a British protectorate. Except in the Juba-land province, where a punitive expedition against the Ogaden Somalis was rendered necessary by the raiding propensities of that tribe, peace had been generally maintained, while a steady increase in the revenue of the territory had manifested itself. In the Tana-land province, where the relations with the natives had been entirely friendly, steps had been taken to open up intercourse with the Abdulla Somalis by the cutting of a track through the dense forest from Port Durnford to their settlement of Biskaya, and it is hoped that on the completion of this road Port Durnford will become a town of some importance. The widening of the Belzoni canal between the Ozi and the Tana was to be taken in hand in September last. It was proposed to move the district head-quarters from Ngao, which has proved unhealthy, to Kipini, which place, together with Kau, would in that case be transferred from the Lamu to the Tana river district. In Ukamba one or two minor punitive expeditions had been necessary, but friendly relations with the Masai had been cemented by an understanding with the chief Lenana. The old Athi district had been subdivided into the districts of Ulu on the right and Kitui on the left bank of the Athi river. Among the circumstances which had acted disadvantageously on the general prosperity were the following: The failure of the rains for the second season in succession, resulting in famine; the plague in India; and the recurrence of the cattle plague, which, as in 1891–92, had commenced in the north of Africa and was gradually making its way south. Other influences affecting trade unfavourably were the decrease in the supply of ivory, due to the new game laws and the suppression of slave caravans; and in that of rubber, due to drought, the closing of the Lamu rubber district, and the regulations for the check of adulteration. That the customs revenue showed a slight increase in spite of these hindrances, is decidedly satisfactory. The native shipping at Mombasa showed an increase of 18 per cent., and the steam tonnage one of about 33 per cent. The trade of Kismayu showed an increase of 50 per cent., but this was partly counterbalanced by a falling-off at Lamu.

Dr. Fischer's Journey in Marocco.—The well-known German geographer, Dr. Theobald Fischer, is at present engaged in a journey of exploration in Marocco, which promises to yield results of importance with respect to the physical geography of the country. A letter from the traveller, giving some account of his journey from the coast to Marakesh, is published in the fourth number of the *Verhandlungen* of the Berlin Geographical Society for the current year. Dr. Fischer says that from the beginning he has had many drawbacks to contend against, and, just before reaching Marakesh, had the misfortune to lose the use of one of his aspiration-psychrometers, which was irremediably damaged. Still, he had been able to do good work, his principal task having been, so far, the exploration of the Tensift, the course of which has hitherto been shown hypothetically on our maps. It flows through an extremely arid tableland, and its immediate valley is in great measure impassable for beasts of burden, which explains the fact that it has hitherto remained practically unknown. Its windings are so numerous and the concave sides of its bends so steep that, in following its course, Dr. Fischer was continually compelled to cross its bed. This would be impossible at high water, but the stream was unusually low at the time of his visit, owing to failure of rain in the district, and the surrounding country was more than ordinarily forbidding. The population is extremely scanty, and the few people met with had never before seen a white man, expressing the greatest surprise that Christians were men like themselves. Dr. Fischer believes that the whole country lying in front of the Atlas is a tableland of tertiary age, composed of horizontal strata of soft sandstones and red clay, together with porous limestones and conglomerates. Along the whole coast between Tangiers and Mogador, on which he was able to make instructive observations, he had seen not a trace of folding. He thinks, too, that the rulers of the country, from the Romans downwards, have never extended their rule beyond the limits of this open country, the folded region of the Atlas having always been the abode of independent Berbers. Dr. Fischer hoped, after being joined by Count Pfeil and Hauptmann Wimmer, to set out for Demnat and Tedla, whence his plan was to make for Casablanca by a new route, and afterwards proceed by Rabat to the district of the lower Sebu.

The Ulanga as a Navigable Waterway.—An examination of a portion of the Ulanga river, and of its tributary the Kihanzi, was carried out in 1897–98 by Hauptmann von Prittwitz und Gaffron, with a view to finding whether these streams would afford a navigable waterway from the coast to the mountainous district of Uhehe. The report of that officer is printed in the fourth number of the *Mitteilungen aus den Deutschen Schutzgebieten* for 1898, accompanied by a map of the Ulanga and its tributaries, based on his surveys. One of the tasks entrusted to Von Prittwitz was the fixing of the position of the Perondo station, which lies near the source of the Kihanzi, at the foot of the Uhehe escarpment, and is of importance as commanding the much-frequented trade route from the plain to Uhehe, though of late it has given place to Iringa, on the upper plateau, as the administrative centre of the whole region. To reach Perondo, the German officer proceeded along the foot of the escarpment from the station of Dwangire, which he subsequently connected by a route survey with Iringa, so that his mapping of the whole region depends ultimately on the position of the latter. From Perondo he navigated the Kihanzi in a canoe, keeping an "askari" constantly in the bows to sound the depth of the stream with a pole. Much difficulty was experienced in the survey, owing to the great number of sharp curves; the channel was also narrow and obstructed by hippopotami, which, it being the dry season, had all left the steppe and assembled in the river. On entering the Ulanga these difficulties ceased, as this river flows in broad smooth curves, which could be laid down individually by means of compass and watch. The rapidity of the stream and the rate of the voyage were also determined, the former being placed at about 2¾ feet a second. As a general result of his examination of the rivers, Von Prittwitz concludes that both the Kihanzi and the Ruipa (another northern tributary of the Ulanga) are useless as waterways, but that the Ulanga can, in the section surveyed, be everywhere navigated by a light-draught steamer, even at low water, and will afford an easy means of communication towards the hills from Ngahoma, above the Pangani falls. Below these falls the Rufiji has already been provided with a steamer.

Dr. Passarge's Journeys in South Africa.—During 1898 Dr. Passarge continued his investigations of the geology and physical features of the region to the south and west of Lake Ngami. In a letter published in the *Verhandlungen* of the Berlin Geographical Society (1898, part 10), he gives a sketch of the principal results of his travels down to June of last year. On the south shore of Lake Ngami he had discovered remains of an old sedimentary formation, which is probably identical with the "Cape" formation. During an excursion to Olifant's Kloof and Gobabis, Dr. Passarge made the interesting discovery that, instead of ceasing at the escarpment of the Damara plateau, the Kalahari strata are continued on the higher ground, and appear to reach almost to Windhoek. Fossil laterite, occurring below the Kalahari sands, seems also to occupy a large area in Damaraland—a fact which points to the former prevalence of a tropical, or at least of a moister, climate. Early in 1898, Dr. Passarge's explorations led him along the Anglo-German boundary in 21° E. An unusual amount of rain was experienced, and day after day the traveller was forced to continue in wet clothes, which brought on fever. An attempt to strike east to Lake Ngami brought his party further north to the Taukhe (Tioghe) river. In a subsequent journey to the north, it was discovered that this river flows 60 miles further east than is shown on the maps; neither the loop to the west nor the sharp elbow at Andara have any existence. At Andara (lat. 18° 2′ 30″ S.) it flows east-south-east, but at the Popa falls (apparently within the German boundary) north-east. The whole interval is broken with rapids, but below the Popa falls, which are caused by a dyke of greywacke, the basin proper of the Taukhe begins, and the course of the stream is unbroken. Dr. Passarge enumerates a considerable number of corrections which must be made in our maps. Dr. Passarge has lately described his travels in full before the Berlin Geographical Society, in a paper of which we hope shortly to give an abstract.

AMERICA.

The Diamond-fields of Minas Geraes.—An interesting account of a visit to the diamond-fields of Minas Geraes, with information as to the present state of the industry and of the province generally, by Mr. H. D. Beaumont, of the British Legation at Rio de Janeiro, has lately been issued as a Foreign Office Report (Miscell. Series, No. 494). The main object of the journey was to learn something of the methods and prospects of the new Boa Vista Company, formed in Paris with a capital of 2,000,000 francs, which, for the first time since the arrival of the Portuguese, is attempting systematic mining on a large scale in the neighbourhood of Diamantina. From Rio the journey was made by rail to Sete Lagoas, the present terminus of the Central Railway, which will, however, in time, be extended to the San Francisco river. Beyond Sete Lagoas, rough mule-tracks were followed, through a country formed of stony hills, scantily covered with vegetation, but intersected by valleys with rich red soil, where the trees grew closer and higher. The district is well watered by small streams, flowing to the Rio das Velhas, and near these vegetation is always fresh, even in the dry season, while sugar-cane, maize, and orange trees grow freely. After crossing a flat tableland, affording good pasturage, trees become rarer, and for the 50 miles between the Paraúna river and Diamantina nothing but rocks breaks the monotony. Above the crossing-place, the Paraúna falls over a cliff 300 feet high, but has very little water in the dry season. Its upper valley has been little explored, but is said to be rich in alluvial gold. Mr. Beaumont sketches the history of the mines at Diamantina from the first discovery of diamonds, in about 1728, to the present day. Since the final extinction of the Government administration known as the "Real Extracçao," in 1845, mining has been carried on by private individuals only, and mostly on a small scale. The property of the new company consists of an elevated plateau adjoining Curralinho, where rich discoveries were made in 1841, and it is proposed to work what is believed to be the original deposit whence the diamonds were washed into the river. It was hoped that work would be commenced during the present year. During his stay Mr. Beaumont made the ascent of Mount Itambe, the highest peak of the Espinaço range. He says that the natives of the district had no knowledge of any previous ascent having been made. The peak was, however, ascended early in the century by Spix and Martius. Mr. Beaumont's notes include statistics of the gold- and other mining of the province, and some details respecting its new capital—Minas, or Bello Horizonte—which four years before had taken the place of Ouro Preto. The picturesque situation of the latter and its historical associations will, he says, make the casual visitor regret the change.

Questions concerning Early Voyages to America.—Two discussions of doubtful points in connection with American discovery have lately appeared. In the fourth part of the *Zeitschrift* of the Berlin Geographical Society for 1898, Mr. P. J. Valentini, of New York, enters very fully into the question of the voyage of Pinzon and Solis in 1508, one on which there has been great variance in the statements of commentators. This arises from the fact that the official report of the voyagers has been lost, and our knowledge has been based merely on scattered notices. The publication, however, of the last volume of the 'Documentos Ineditos,' has made available some important information respecting the voyage in question, and various doubtful points can now be cleared up. Mr. Valentini begins by summarizing the accounts previously made public, showing the great discrepancies which exist between them. Whilst the earliest document (1513) tells merely of a voyage (in 1508) on the western shores of the Caribbean sea, Peter Martyr extends it eastward to the province of Paria, while Herrera connects the former account with 1506, and speaks of a second voyage extending to 40° south in 1508.* Of the new documents, one of the most important is the despatch of the king to the "Casa de Contratacion" in Seville, setting forth the objects of the proposed voyage, and the proceedings to be observed in its prosecution. From the whole information available, there is little room for doubt that the voyagers sailed in 1508 for Honduras, that they followed the coast to the west and north, and returned to San Domingo in August, 1509, De Solis being then under arrest. Mr. Valentini traces the course of the voyage, identifying the various points touched at with places on the coast of Honduras and Yucatan, ending with Cape de Catoche, the northernmost point of the latter. He shows how the accounts of Peter Martyr apply in the minutest points to the Maya and Nahuatl Indians, but not at all to those of Paria, and he considers that the priority of Pinzon and Solis over Cordova and Grijalva, as discoverers of Yucatan, is fully established. The other publication alluded to is a *résumé* of the question of Jean Cousin's apocryphal voyage to Brazil in 1488, given by E. Le Corbeiller in the *Bulletin* of the Paris Geographical Society. He prints at length the statements of Desmarquets, the only authority for the supposed voyage, and shows that, while confirmation is still wanting, the objections raised by Fernandez Duro and others, on the score of the improbability of certain details, fall to the ground, and that the question is still an open one.

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* Herrera's account of the 1508 voyage has been followed without question by recent writers like Kretschmer, as well as by Major and others. Mr. Weise ('Discoveries of America') quoted only his account of the supposed 1506 voyage, which contains more details than would be supposed from Mr. Valentini's statement, mentioning, *e.g.*, the fact that the greater part of Yucatan was discovered.

Dr. Steffen on the West Coast of Patagonia.—News of Dr. Steffen's latest expedition, which, as we have already announced, set out in November last, is published in the third number of *Petermanns Mitteilungen* for the present year. Writing on December 31 from Baker channel in a little north of 48° S. lat., Dr. Steffen reports that so far good progress had been made in the prosecution of the enterprise. In company with Mr. Hambleton, he had crossed over the isthmus of Ofqui to the head of the Gulf of Penas, while the rest of the expedition made the circuit by sea round the Tres Montes peninsula and joined him at the harbour of San Quintin. An examination was then made of the various fiords by which the east coast of the Gulf of Penas is intersected, but until Baker channel was reached, all were found to be blocked at the head by ice-walls, so that a passage across the Cordillera between 46½° and 47½° would present great difficulties. Three large rivers, however, flow into Baker channel, the eastern branches of which extend more than 60 miles inland, and these once more afford access to the interior. The largest, named by Dr. Steffen the Rio Baker, may be compared with the Rio Cisnes; it comes from the east-north-east, and, from its appearance, colour, and temperature, may be supposed to issue from a lake, probably Lake Cochrane. Another stream with a broad valley comes from the east, and seems to be fed by the glaciers of a distant snow-mountain, seen by the party, and supposed by Dr. Steffen to be Mount Cochrane (about 47° 40′ S.). A copious and very rapid stream, apparently fed also by distant glaciers, enters the south-eastern arm of Baker channel. Dr. Steffen thinks it may be the lower course of the Rio Mayer discovered by Mr. Hatcher (*Journal*, vol. xi. p. 72). The two rivers last mentioned have been named respectively Rio Bravo and Rio de la Pascua. Some details are given respecting the vegetation of the coast, which south of San Quintin suddenly becomes rachitic. The heights are covered to a certain extent with mosses, but the snow-level is no higher than 2000 feet. Constant rain was experienced in the neighbourhood of Baker channel. Dr. Steffen hoped to make his way by the Rio Baker to Lake Cochrane, and, joining there the other section of the expedition under Herr Krautmacher, to march southwards thence to Punta Arenas.

AUSTRALASIA AND OCEANIC ISLANDS.

Life on a Pacific Island.*—Mrs. Edgeworth David, who accompanied her husband on the boring expedition of 1897 to Funafuti, has written a lively and readable account of her experiences during the three months spent by the party on the island. It makes no attempt at geographical description—indeed, very little at all is said as to the nature and characteristics of the island itself; but in addition to the personal incidents, it gives a striking picture of native life and manners in a particularly out-of-the-way part of the world. On her arrival, Mrs. David soon made friends with the natives, for whom she shows a genuine sympathy, and the close intercourse she had with them—entering into their family life, doctoring their ailments, and studying their characters—enables her to make her account of them unusually complete and accurate. They appear to be an amiable and easily managed people, living contentedly under an excellent code of laws, framed on the basis of their own ancestral customs, and to be sincere in their profession of Christianity. Laziness and obstinacy are the worst defects Mrs. David has to find in their characters. She was much impressed with the Funafuti singing, which is performed with a great deal of "go," and in perfect time. The number of native songs is enormous, and musical evenings or "sing-sings" are a regular institution. Among the songs, those founded on Biblical incidents—often rather laughable—play an important part. Adoption is a very common and very real thing in the island, and Mrs. David was soon provided with a native mother and daughter. The book contains a chapter on the animal life of Funafuti, the most interesting point touched upon being the somewhat problematical existence of a strange fish called the "palu," rarely caught, but for which a special kind of hook, 8 inches long, is manufactured; it is cut solidly out of a tough hardwood. Besides the main island, the atoll contains other islets, to one of which—Funafala—most of the people migrate for three months in the year, fishing for bonito and making *copra*, the island being well-planted with coconuts. Mrs. David says that the idea of coconuts being landed on a newly emerged reef, and sprouting and growing, seems to be a fairy tale, as the natives laugh at the notion of a self-raised coconut. Prof. Bonney contributes an appendix on the scientific results of the expedition, in the form of a sketch of the work accomplished; but until the cores are thoroughly worked out, it is of course too soon to discuss the lessons to be learned from them. He seems, however, to have no doubt that the rock obtained at great depths is true coral reef.

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* 'Funafuti; or, Three Months on a Remote Coral Island.' By Mrs. Edgeworth David. London: Murray. 1899.

POLAR REGIONS.

Expedition of the Duke of the Abruzzi.—The Duke of the Abruzzi hopes to sail from Laurvig, on the Christiania fiord, *en route* for the North Polar regions, about the middle of June. The expedition consists of twenty-one persons, the second in command being Captain Cagni, who accompanied the duke on his expedition to Mount St. Elias. The *Stella Polare*, a brigantine with auxiliary steam-power, has been greatly strengthened for the voyage, and will carry 350 tons of coal in addition to 250 tons of provisions and other equipment. Particular care is being bestowed on the arrangement of the outfit, which will be divided into four sections, contained in boxes of different colours in order to facilitate the salvage of the most important in case of accident. There will be about 1500 in all. Two balloons are being carried for use if occasion requires.

Dr. Nathorst's Expedition.—Dr. Nathorst left Stockholm towards the end of May, on board the *Antarctic*, on his expedition to the north-east coast of Greenland. His party consists in all of twenty-eight persons. Dr. Nathorst, who still has hopes of finding Andrée and his companions in Greenland, intends if possible to land between 73° and 76° N., and should no intelligence of the missing explorers be there obtained, to push on towards Cape Bismarck, where it is possible he may meet some members of Captain Sverdrup's expedition.

Degree Measurement on Spitsbergen.—Arrangements have been completed for the Russo-Swedish expedition to Spitsbergen for the measurement of the degree, two steamers and a considerable sum of money having been placed at its disposal by the Russian Government. Admiral Makarof's ice-breaker, the *Yermak*, will, it is said, accompany the expedition to Spitsbergen before proceeding to the mouth of the Yenesei.

GENERAL.

The Seventh International Geographical Congress.—The preliminary programme of the Seventh International Geographical Congress has been issued.

The Congress is to meet at Berlin from Thursday, September 28, to Wednesday, October 4, a meeting of welcome being, however, arranged for the evening of September 27. The meetings will take place in the new buildings of the Prussian House of Representatives, 5, Prinz-Albrecht Strasse; and the meetings in the forenoons will be of a general character, those in the afternoons sectional, as at the London Congress. A special ladies' committee has been formed in order to make the sojourn in Berlin of the lady members and associates as instructive and agreeable as possible. All papers for the Congress should be sent in by July 1, and twenty minutes have been assigned as the limit of each contribution, which may be given in the German, English, French, or Italian language. A formidable list of honorary presidents, honorary vice-presidents, honorary foreign committee, and German honorary committee is given. There are also an executive committee, and sub-committees for general organization, finance, scientific organization, excursions, proposals to the Congress, press and editorial, and finally correspondence. The following provisional programme has been drawn up:—Group I. *Mathematical Geography.*—(*a*) Mathematical Geography and Geodesy. On the figure of the Earth, position of mean sea-level and variation of latitude, etc., by Prof. Helmert, M. Charles Lallemand, and others. (*b*) Cartography. Prof. Penck, on his proposed map of 1 : 1,000,000; Profs. Supan and Wagner, on the importance of marking the natural scale on all maps; and others. (*c*) Geographical Measures. Dr. H. R. Mill, on the introduction of the metric system in all scientific work; Dr. Lehmann, on the general introduction of the centigrade thermometer scale, and a report on the decimal division of time and angles. (*d*) Geophysics. Dr. Börgen, on the present state of research on the tides. Prof. Gerland and Dr. Hecker, on seismic research. Group II. *Physical Geography.*—(*a*) Geomorphology. Prof. Davis, on the geographical cycle; Prof. de Lapparent, on peneplains in the light of geology; Dr. Philippson, Prof. Oscar Lenz, and Prof. Charles Barrois, on various regional characteristics. On limnology, by M. Delebecque, Prof. Forel, and Dr. Halbfass. On the introduction of an exact nomenclature for glacial research, by Prof. Richter; and on glacial land-forms, by several authors. (*b*) Oceanography. On the results of the oceanographical observations made on their several expeditions, by Dr. Nansen, Prof. Chun, the Prince of Monaco; and other papers by Dr. Natterer, Prof. Pettersson, Sir John Murray, Prof. Thoulet, and others. On the introduction of a systematic international nomenclature of the forms of the ocean floor, by Prof. Wagner, Prof. Krümmel, Dr. H. R. Mill, and Prof. Voeikoff. (*c*) Climatology. On balloon observations, by Prof. Hergesell and Prof. Assmann; and rainfall, by Prof. Brückner. Group III. *Biogeography.*—On the geographical distribution of plants, by Profs. Engler, Drude, Warburg, and Nehring. Group IV. *Anthropogeography.*—Numerous papers on social, commercial, and political geography, by different authors, including Prof. Ratzel, Prof. Turquan, Mr. Poulteney Bigelon, and Mr. John McEwan. Group V. *Exploration.*—(*a*) Antarctic Regions. On the plan and equipment of the proposed Antarctic Expeditions, by Sir Clements Markham, Dr. Erich von Drygalski, and Sir John Murray. (*b*) Arctic Regions. Papers noted under Oceanography. (*c*) America. The physical geography of the State of Missouri, by Miss L. A. Owen. (*d*) Africa. Papers by Prof. Hans Meyer, Dr. Siegfried Passarge, Count Götzen, Dr. Claparède, and Prof. Th. Fischer. (*e*) Asia. Observations during a crossing of Asia, by Prof. Futterer; and other papers. (*f*) Europe. Papers on Bosnia and Croatia. Group VI. *Historical Geography.*—On the influence of humanism in the history of geography, by Prof. S. Günther; on the history of the first discovery of England, by Prof. Sieglin; and papers by Prof. Wagner and others. Group VII. *Educational, etc.* On education and orthography, by various authors. On a uniform system of contractions for the titles of geographical journals, by Prof. Penck. A series of excursions has been arranged for during the week preceding and the week following the meeting of the Congress, concerning which full particulars will be given later.

The Mean Distances from the Coast in the Oceans.—This subject has lately been dealt with by Dr. J. de Windt, in a note published in the *Mémoires Couronnés* of the Belgian Academy of Sciences, and issued separately as a reprint. The calculation had never before been carried out for the oceans, although the continents had already been dealt with both by Rohrbach and Penck, whose methods are adopted by Dr. de Windt. The writer made the necessary measurements on charts of the three oceans on Lambert's equivalent projection, reductions of which accompany his article. Drawing the lines of equal distance (called by him Isochores), at intervals of 500 kilometres, he first obtains, by the use of Amster's polar planimeter, the extent of surface included by each successive line. At a greater distance than 2000 kilometres, he finds that the Pacific ocean contains 9,920,000 square kilometres (3,769,600 square miles), and the Atlantic ocean 20,000 square kilometres (7600 square miles), the Indian ocean containing no portion beyond that distance. The mean distances from the coasts, obtained by the measurement of the chorigraphical curves, are as follows:—

Pacific ocean	765 km.	= 475 miles.
Atlantic ocean	606 „	= 375 „
Indian ocean	621 „	= 386 „

The maximum distances being respectively 2265 km. (1407 miles), 2050 km. (1273 miles), and 1700 km. (1056 miles). Dr. de Windt has also calculated both the mean and maximum distances in the case of spherical caps of equal area with the respective oceans, and, from the proportion which the two sets of figures bear to each other, finds that the Indian ocean presents, relatively to its area, the greatest mean distance, the Atlantic the greatest maximum distance, the Pacific standing last in either case. With respect to the distribution of the isochores, some interesting facts are noted. In the Pacific the 500-kilometre line embraces in one continuous area all the islands but the Hawaiian and three other small groups, while a line drawn at half that distance divides the main island complex into a number of separate areas. Beyond the 1500 kilometre line there are two water areas, one running from north-west to south-east, parallel to the American coast, the other from east to west between New Zealand and South America. The portions of the Atlantic lying beyond this line are: (1) the Central North Atlantic between the Bermudas and the Cape Verd group; (2) a small area between Tristan da Cunha and South America. The Indian ocean contains only one such area, extending in a narrow band west and south of Australia.

Work of the Russian Geographical Society in 1898.—At the anniversary meeting of the Russian Geographical Society, held on February 2, the usual report of the Society's work for the year was read. Among the losses by death during 1898, those of Signor de Rossi, the well-known Italian seismologist, a foreign corresponding member; and of the active members, F. K. Velichko and N. D. Jurgens, deserve special mention. The latter was leader of the expedition of 1882–83 to the mouth of the Lena. In addition to geographical work already referred to in our pages, the following was carried out under the Society's auspices during 1898. The southern part of the Kola peninsula was visited by an expedition under P. B. Rippas, mining engineer, and A. A. Noskoff, topographer, special attention being paid to the previously unexplored part adjoining the basin of the Barsuga. In the Caucasus, H. B. Poggenpol ascended almost to the summit of Elbruz, and examined the glaciers of its neighbourhood, proving the possibility of the establishment of a meteorological station on the mountain at a height of 12,300 feet. Geological and phytogeographical investigations were made by N. T. Andrusoff and N. T. Kutznetzoff, who visited Daghestan and Kakhetia. Material for a botanical map of the latter was also obtained by A. V. Fomin. In Central Russia, E. E. Leist continued his researches in terrestrial magnetism, while barometric levelling was carried on in the Southern Ural, between the Belaga and Yaik, by the Orenburg section of the Society. In the province of Akmolinsk, a series of fresh and salt water lakes, with their surroundings, was explored, at the part expense of the Western Siberian Section. The Society also took part in the international investigation, by balloon, of the upper layers of the atmosphere. The balloon ascended twice at St. Petersburg, reaching on the first occasion a height of 8300 metres (27,200 feet); and once at Kieff, during the tenth congress of Russian naturalists, reaching then a height of 10,100 metres (33,100 feet). Ethnographical work was done by the expedition for the collection of Russian national songs, which worked during the year in the governments of Perm and Novogorod, and by other observers elsewhere. In Persia extensive journeys were made by N. A. Zarudnui, especially in Khorasan and other eastern districts. He has brought back extensive topographical and hypsometrical material, meteorological observations, and zoological collections. The highest award of the Society, the Constantine Medal, was awarded to Dr. G. F. Radde, while other medals were given to Messrs. Pomerantzoff, Kleiber, Gondatti, Yachevski, and others.

Awards of the Paris Geographical Society for 1899.—The chief awards of the Paris Geographical Society have been made as follows: A special gold medal is given to General Gallieni, for his work in the Sudan, Tongking, and Madagascar; the Society's gold medal to M. Gentil, for his explorations in Central Africa; while nine other gold medals, being the premiums founded by private individuals, go to various travellers, writers, and cartographers, including the Marquis de Bonchamps, Mr. F. G. Jackson, and several officers who have distinguished themselves during the French operations in the Sudan. A special award is also made to M. Brenier, head of the recent Lyonese Mission to China.

OBITUARY.

Heinrich Kiepert.

By the death of Prof. Dr. Heinrich Kiepert, which occurred at Berlin, after a long and painful illness, on April 21, there has passed away from our midst one of the most distinguished geographers and cartographers. Born at Berlin on July 31, 1818, young Kiepert received his scientific education at the university of his native city, devoting his attention more especially to history, philology, and geography. The first work which he published, with the co-operation of Prof. Karl Ritter, was an 'Atlas of Hellas' in twenty sheets (1840–46), which at once established his reputation, and his future work fully bore out the expectations that were raised when first he came before the public. As a cartographer his activity was of the most varied kind, but his name will more especially be remembered in connection with his maps illustrative of ancient history and of the geography of Asia Minor. Among his more general cartographical works may be mentioned a fine 'Hand Atlas' in forty-five sheets (Berlin: Reimer, 1855); sets of school wall-maps, prepared by order of the Berlin School Board; and a series of globes distinguished for beauty of design and execution. His first 'Atlas of the Ancient World' appeared in 1848 at Weimar, where he resided from 1845–52 as director of the Geographical Institute. An improved 'Atlas Antiquus' was published for the first time in 1854.

To Prof. Kiepert we are likewise indebted for the very valuable maps illustrating the 'Corpus inscriptionum latinarum.' He is the author of numerous essays on ancient geography, one of which, dealing with the wars between the Byzantine Empire and the Sassanides, was crowned by the Paris Academy in 1844, as also of a much valued 'Lehrbuch' of ancient geography (1879), an English translation of which was published in 1881. To Asia Minor he devoted a considerable share of his time, and between 1841 and 1892 he four times visited that peninsula in order to collect materials. His first map, in six sheets, was published in 1843–46; a new map on the same scale appeared in 1854, and for many years previous to his death he had been collecting materials for a large map of Asia Minor, on a scale of 1 : 500,000. The British, Russian, and French War Offices freely supplied him with the materials at their disposal; but Kiepert was not permitted to complete this work, and in a letter written not much more than a year ago, foreseeing his end, he expressed a hope that his son (Dr. Richard Kiepert, born 1846) would bring it to completion. Kiepert, since 1859 professor of geography in the University of Berlin, has left behind him many works in a state allowing of their early publication, including several maps designed for the 'Corpus inscriptionum,' and a second part of his 'Formæ Orbis Antiqui.' The materials on Syria and Mesopotamia, which he accumulated in the course of years, have been embodied by his son in a map which is to be published shortly.

Dr. Kiepert was elected an honorary Corresponding Member of our Society in 1862.

CORRESPONDENCE.

'Sir John Maundeville.'

Referring to Captain A. W. Stiffe's letter on 'The Marvellous Adventures of Sir John Maundeville' in the March number of our *Journal*, I should like to call attention to the paper, "Johann von Mandeville und die Quellen seiner Reisebeschreibung," by Albert Bovenschen, which was published in the *Zeitschrift* of the Berlin Geographical Society (vol. xxiii. pp. 176–306), and is, apparently, not so well known as it deserves to be. The author of this remarkable and exhaustive paper comes to the conclusion that the 'Adventures' were written by a learned doctor of medicine, "Jean de Bourgoigne dit à la barbe," who, to keep up the deception of a lifetime, assumed the name of Mandeville when on the point of death, and died and was buried at Liége in 1372; that this doctor, the real author of the 'Adventures,' never visited any of the Eastern countries he describes, with the exception of Egypt, but was an exceedingly well-read man, and copied nearly the whole of his text from other authors. Bovenschen gives all the authorities, with chapter and verse, and I am afraid that Colonel Yule's verdict to the effect that the so-called Mandeville was an impostor is correct.

A. Houtum-Schindler.

Teheran, March 30, 1899.

'Short Studies in the Science of Comparative Religions.'

The notice of the presentation copy of the above in the April issue of the *Royal Geographical Journal* gives a misleading idea of this work and of my views on "the origin of religions."

The work is one of purely historical research, tracing the ten great religions of the word, doctrinally and geographically, through the ages, and on this account sent to the Royal Geographical Society.

It is not concerned with any particular phase, symbolisms, or "origin of all religions," but only with the facts of faiths, which are elaborated in three sets of chronological tables, with running text and commentary. Necessarily, there "is a mass of learning," but neither "curious," speculative, nor peculiarly my own; but history, which must be accepted or refuted by the historical method.

J. G. Forlong.

Edinburgh, May 2, 1899.

The Area of the Philippine Islands.

In several Government documents the statement is made that the area of the Philippine islands is something over 114,000 square miles. In the latest one just received, it is given as 114,326 square miles. This error has doubtless arisen from a hurried examination of the Spanish documents. We find in the 'Guia Oficial de las Islas Filipinas,' para. 1898 (publicada por la Secretaria del Gobierno General; Manila, 1898), the statement that the archipelago comprises an area of 355,000 square kilometres, without including the Joló (Sulu) group. It then specifies about thirty of the principal islands, and their areas aggregate 298,485 square kilometres. That, of course, leaves a multitude of the smaller islands not specified in the guide, but covered by the larger area. The number of square kilometres multiplied by 0·386052 will give the area of the islands specified as 115,238 square miles; and the area of all the islands, less the Joló group, amounts to 137,057 square miles.

Further, the statement is generally made that the archipelago of the Philippines contains from 1000 to 2000 islands, and the 'Guia Oficial' says the number is more than 1200. But, in examining the 'Derrotero del Archiépelago Filipino' (Madrid, 1879), that is, the coast pilot of the Philippines, covering more than 1200 pages, we find that the islas, islitas, isletas, islotes, islotillas, and farallones therein described amount to 583. Of course this does not include reefs, rocks, or hidden dangers.

George Davidson.

Geographical Society of the Pacific, San Francisco, Cal.

Hannibal's Pass once more.

In his comments on my account of my own belief as to this much-disputed question, Mr. Freshfield repeats many of the arguments formerly urged by him. As I still differ very widely from him, I beg leave to state as concisely as possible the principal reasons for my belief.

First of all, let me say at once that I am quite at one with Mr. Freshfield in desiderating "historical insight," as well as knowledge of the localities and of the texts. But while I agree that historical insight may so illuminate a number of apparently unconnected historical facts that they at once fall into their proper place, and thus an addition to our previous knowledge is made, I must confess that Mr. Freshfield's use of this "insight" seems to me to come often to no more than plausible guessing in the total absence of authentic facts, one way or the other. If a vacuum is lighted up ever so brilliantly, the vacuum itself is not filled up, but its true nature becomes more evident than ever; and this, I hold, is the case with the history of the Mont Cenis before the eighth century A.D. After this general remark, I proceed to take Mr. Freshfield's arguments in the order in which he has stated them.

1. The first thought that occurs to me as to Mr. Freshfield's explanation of the passage from Varro is this: if all be so clear and simple as Varro's champion urges, how is it that the whole discussion has not been closed long ago? If it is shown that Hannibal *cannot* have crossed the Mont Genèvre, why is it that very many recent writers conclude that he *did* cross this pass? Now, we know that the Romans hated and feared the Alps with an energy that astonishes us in modern

times, and that their maps of those regions were about as confused and erroneous as possible. Yet we are asked to believe that one of these Romans deliberately set to work to explore the passes across the Western Alps, and deliberately summed up the results of his journeyings in a few lines, enumerating the names of three generals who had crossed these Alps, but unluckily omitting in just these three cases the names of these passes (or their approximate position), and making the gross error of stating that the "Graian Alps" had formerly been held by the Greeks! Even the most learned writers err sometimes, with the best intentions, and in the most perfect good faith. It was only the other day that a friend of mine, than whom few know more about the Romans, asked me quite seriously whether the Alps could now be crossed at more than three points between the Mediterranean and Mont Blanc, and expressed immense surprise when I replied that I had myself crossed them between those limits by probably 100 or 150 different passes.

There is, too, a further consideration that seems to have escaped the attention of Mr. Freshfield. It is no doubt very tempting to identify the three passes indicated by Varro between the sea and the Little St. Bernard with the three passes in that region now traversed by carriage roads—the Argentière, the Mont Genèvre, and the Mont Cenis. Now, two of these three carriage roads were made by the first Napoleon, and that over the Argentière planned by him, though not completed till quite recently. But I can assert of my own personal experience that within the limits named there are not a few foot or mule passes which are easier and better in every respect than these three carriage passes. None of these generals crossed the Alps *summâ diligentiâ*, and why should we be tied down to identify these three passes of Varro with the three that for engineering reasons happen now to be provided with carriage roads? Here is a case for "historical insight."

2. Mr. Freshfield admits unreservedly that we possess no direct proof of the early passage of the Mont Cenis from monuments or documents. That is all I have ever maintained—that our present evidence does not allow us to push back the authentic history of this pass beyond the eighth century A.D. Some day, perhaps, a discovery of a charter or monument at present unknown may help us; till then "honest doubt" must prevail. But few, very few, will go with Mr. Freshfield in holding that Cæsar crossed the Mont Cenis; even Napoleon III., in his 'Life of Cæsar,' did not. Further, Mr. Freshfield holds that the Mont Cenis was constantly used as early as the sixth century A.D.—of which below—adding the absolutely startling assertion, that "by that date" it had "superseded" the Mont Genèvre as the main road between France and Italy!! The only authority that he cites for all this has been already given by him in the *Alpine Journal*, No. 81,* and now reappears with many fanciful details. Space does not allow me to discuss the latter, and it is needless, for every student of the history of the Maurienne is perfectly well aware that the bishop's see in that valley cannot be dated authentically earlier than the sixth century, while the foundation of Novalesa in 726 simply confirms the ascertained fact that in the eighth century the Mont Cenis was certainly known and traversed.

It will be noticed that Mr. Freshfield sometimes urges that the Mont Cenis itself was crossed in the sixth century A.D., and sometimes merely one of the passes between the Arc valley and the Dora Riparia valley. Now, I am only concerned here to deny this statement so far as regards the Mont Cenis, for it is evident, from the sixth-century documents, that *some pass* was known between the Maurienne and Turin. It *may* have been the Mont Cenis; it *may* have been another; we can assert the existence of a pass, but we cannot put a name to it. Now, there are a great number of passes amongst which to make a choice, and all are known personally to me. From St. Jean de Maurienne itself several lead over to the undoubted Roman road over the Col du Lautaret (which joins that over the Mont Genèvre at Briançon), and this road may also be reached by several others starting from St. Michel de Maurienne, a little higher up the Arc valley. Others lead direct from Modane and its neighbourhood to the Dora Riparia valley. Now, most of these are shorter in point of distance than the Mont Cenis, and are also easier. If I were to give reins to my "historical insight," I should select the Col de la Roue, 8419 feet (an extremely easy pass), by which it is possible to go, in about five hours' walking, from Modane (17 miles above St. Jean de Maurienne) to Bardonnèche, which is only 7 miles above Oulx, on the Roman road of the Mont Genèvre.

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* I may be permitted to say that since I wrote my previous note, I have carefully examined in detail the other facts alleged by him in that article, and they have all broken down. It is only fair to add that Mr. Freshfield collected them from various sources, without apparently himself verifying the references.

But, unless some new bit of clear and authentic evidence is produced, I maintain my statement that the Mont Cenis is certainly known only from the eighth century A.D. onwards, though from the sixth century some pass (to which we cannot attach a name) was in use between the Maurienne and Turin.

3. Mr. Freshfield next indulges in some flourishes about documentary evidence not being necessary (despite the purely historical nature of the question!), the genius of the Roman race, the inconceivability of the Mont Cenis not having been known before the eighth century B.C., etc. I venture to pass by this rhetoric with three remarks as to matters of fact. One is that the Roman town of Susa is just as much on the route over the Mont Genèvre as on that over the Mont Cenis. The second is that till the carriage-road was made by Napoleon, the Mont Cenis (especially the descent to Susa) was one of the most difficult and dangerous among the frequented passes over the Alps. The third is that Mr. Freshfield should not commend Simler's sixteenth-century book too warmly, for (despite the natural inclinations of a scholar) he does not breathe a syllable about a Roman road over the Mont Cenis, though devoting nearly a page to the description of the pass; further, the Col de l'Argentière is entirely omitted by Simler, although he repeatedly quotes Paul Jovius' account of the Alps, an account that is actually on the same page of that writer's 'History of his own Times' as his description (the first detailed one we have) of the Argentière *à propos* of Francis I.'s passage in 1515!

4. Mr. Freshfield has the advantage over me of having been in the Caucasus. But it is not really necessary to wander so far in search of passes in the mountains locally known and used freely, yet rarely marked on general maps. Let me just cite the names of a few such passes (some of which can only be traversed by mules) between the Argentière and the Little St. Bernard, all crossing the main chain, and all very well known to me—the Col de Mary, the Col de Longet, the Col dell' Agnello, the Col de la Traversette, the Col de la Croix, the Col des Echelles de Planpinet, the Col de la Roue (already mentioned), the Col d'Etache, the Col de l'Autaret, the Col du Mont. Most travellers have never even heard of these passes, but the country people use them almost daily, as well as armies occasionally, and yet they have little, if any, written history.

5. I have not seen Dr. Osiander's treatise, though, as Mr. Freshfield fights shy of him, my ignorance of this book can do no one any harm. But Mr. Freshfield does not mention an even later monograph on the mountain region that we are engaged in studying—Monsieur R. Rey's monograph entitled 'Le Royaume de Cottius et la Province des Alpes Cottiennes d'Auguste à Dioclétien' (Grenoble, 1898). According to M. Rey (who is well up in the 'Corpus Inscriptionum,' etc., etc.), the valley of the Maurienne above St. Jean de Maurienne formed part of the

province of the Cottian Alps. Yet, despite his minute discussion of every conceivable point relating to the Romans in this province, including the Roman roads, M. Rey has not a single word to say as to a Roman track across the Mont Cenis (or, indeed, anywhere between the Maurienne and any valley in the direction of Turin), boldly leads both Hannibal and Cæsar across the Mont Genèvre, and recognizes the Argentière as a Roman road by reason of the Roman remains found along this route, though denouncing the inscriptions as forged.

6. I still hold to my definition of the "foot" of a pass, which is quite different from the "foot of the mountains." If Borgo San Dalmazzo is at the Italian "foot" of the Argentière, the French "foot" of that pass must be, not Barcelonnette (as is usually considered to be the case), but somewhere near Lyons, where the road leaves the mountains. Mr. Westlake will not get much help for his Hannibalian theory by placing the "foot" of the Argentière at Borgo San Dalmazzo, for there the route of the Col de Tenda joins that from the Argentière, so that this argument is double-edged. Similarly, as the routes from the Mont Genèvre and the Mont Cenis join at Susa, any argument as to the length of the plains from the point at which the joint route reaches them to Turin applies to either pass, and not exclusively to one or the other. But this narrow definition of "foot" leads to practical absurdities. According to this theory, the Great St. Bernard pass extends, not from Martigny to Aosta, as is generally believed, but from somewhere near Lyons to Ivrea, while the ice-clad Col du Géant (connecting Chamonix and Courmayeur) must also be taken to extend from near Lyons to Ivrea!

I may note, in passing, that Mr. Freshfield is absolutely mistaken as to Brockedon's use of the expression, "The Pass of the Argentière," for his first words are, "The route from Coni to Embrun, by the Col d'Argentière, lies through Borgo San Dalmazzo."

7. I greatly regret that I gave Mr. Freshfield the impression that Fuchs had enumerated every article and work relating to Hannibal's passage; as the tractate is only 152 pages in length, this is clearly impossible. I am sorry that Mr. Freshfield cannot find in Fuchs any reference to that well-worn passage of Varro, but the reason is not far to seek. It is, no doubt, a more serious crime that Fuchs is unaware of Mr. Freshfield's papers on the Argentière in the *Alpine Journal* (papers also printed in the *Proceedings* of the R.G.S.; and simply echoed by Prof. Schiller and Mr. W. T. Arnold), but I fear that that periodical (in which many of my writings also are buried) is not very well known outside climbing circles. Mr. Freshfield, too, seems unaware of the fact that the Italian name of the Argentière is the "Colle della Maddalena," the name of "Maddalena" being also given to the great plain that forms the summit-level of the pass. And really, when Mr. Freshfield states that Mr. Ball and Prof. Bonney (I must plead ignorance as to Sir E. H. Bunbury's Hannibalian views) are opposed to the claims of the Little St. Bernard, he should have added that their views are, as far as I am aware, expressed simply in a *résumé* of the arguments of Mr. Ellis (in 1854) in favour of the Little Mont Cenis; this *résumé* was given in the older editions (from 1863 onwards) of the 'Western Alps,' and was (I am proud to relate) erased, root and branch, by me when preparing the new edition (1898) of that work, for its arguments had been refuted in detail by Mr. W. J. Law, in his 'Alps of Hannibal' (1866).

In my humble opinion, the Mont Cenis (big or little) and the Argentière are, with perhaps two or three exceptions, the most "impossible" Hannibalian passes from an historical and a practical point of view. I can therefore easily understand why some writers do not feel called upon to even mention them. And, personally, I should be very sorry if Mr. Freshfield were to incur the fate of the Oxford scholar, who, having edited some classical author, long searched in vain in the pages of succeeding editors for any mention of his *magnum opus*, until one terrible day he found the following brief remark by a stony-hearted German editor, "pessimè Shawius."

8. I cannot believe that Mr. Freshfield is serious in holding that it is unnecessary to traverse obscure Alpine passes when making Hannibalian researches. Why, then, did he himself (with me in his train) cross the Argentière in June, 1883, and only publish his first article in the following August? I myself wandered for years over Alpine passes south of Mont Blanc without any thought of Hannibal, and so without any prejudice one way or the other. But when my attention was drawn to the Hannibalian question, I had no hesitation in deciding that in my opinion the Mont Genèvre was the only possible pass. And if I ventured to express this opinion and this experience in these pages, it was because I thought and think that practical knowledge was worth as much as book knowledge; for if Mr. Freshfield has crossed the five great passes, I have crossed them too, some more than once, and perhaps 100 or 150 more to the south of Mont Blanc to boot.

9. I cannot conceive how either Mr. Westlake or Mr. Freshfield can find comfort and support from my historical note as to the Argentière. Can either of them quote a case of any authentic traverse of this pass by an army between the time of the Romans and 1515? I fancy they will find some difficulty in doing this; and if they cannot, will they kindly explain why this "most natural route from Spain to Italy" was unused for 1500 years?

W. A. B. Coolidge.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898-1899.

Ninth Ordinary Meeting, April 24, 1899.—Sir Clements Markham, K.C.B., President, in the Chair.

Elections.—*Edward Case, C.E.; Frank James Gray, C.E.; Major Henry W. Wright Guise, 8th Regiment (The King's); Lieut.-Colonel George Rowley Hadaway (late R.A.); Charles Cory Kernick; Vincent T. Murché; Rev. Roland Taylor-Warren; Richard Glyn Vivian; Rev. Percy St. Michael Podmore, B.A.*

The Papers read were:—

(1) "The Nyasa-Tanganyika Plateau." By Captain F. R. F. Boileau, R.E.

(2) "Journeys on the Tanganyika Plateau." By L. A. Wallace.

Tenth Ordinary Meeting, May 8, 1899.—Sir Clements Markham, K.C.B., President, in the Chair.

Elections:—*Captain F. R. F. Boileau, R.E.; Ebenezer Wm. Briggs; Captain J. E. Brogden (Army Medical Corps); Lieut. Percy A. Clive (Grenadier Guards); John S. Hall; Wm. Holland; William Alfred Johnstone; Captain H. G. Joly de Lotbinière, R.E.; Commander Alexander McKay; Rev. Ernest Hilton Molesworth, M.A.; William Llewellyn Preece, M.I.E.E., A.M.Inst.C.E.; Rudolph Wallace Rose; Rev. Haskett Smith, M.A.; James Stuart; Lawrence Aubrey Wallace, A.M.Inst.C.E.; Colonel Francis Palmer Washington, R.E. (retired); Dr. A. Blair Watson; Walter D. Wilcox, B.A.; Thomas Loxton Woods.*

Honorary Corresponding Members.

H.S.H. the Prince of Monaco; Capitan de Navio Don E. Fernandez Duro; M. Jules Leclerq; Dr. E. Bretschneider.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 280–326. **Geyer.**
Ueber die Hauptkette der Karnischen Alpen. Von George Geyer. *With Illustrations.*

Alps. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 98–122. **Zwiedineck-Südenhorst.**
Die Ostalpen in den Franzosenkriegen. Von Hans v. Zwiedineck-Südenhorst. II. Theil. *With Illustrations.*

Alps—Plants. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 61–68. **Pax.**
Das Leben der Alpenpflanze. Von F. Pax.

Austria. **Whitman.**
Austria. By Sidney Whitman. With the collaboration of J. R. McIlraith. London: T. Fisher Unwin, 1899. Size 8 × 5½, pp. xx. and 408. *Map and Illustrations. Price 5s. Presented by the Publisher.*

This is "a succinct but unbroken record of the history of Austria as connected with the Imperial house." It deals with Austria in the strict geographical sense of the name.

Austria—Galicia. *Blackwood's Mag.* **165** (1899): 669–681. **Lorimer.**
At the Back of Beyond. By Louise Lorimer.

Description of a tour in Galicia.

Austria—Tirol. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 143–181. **Kübler.**
Das Tannheimer Thal. Ethnographische Skizze von Dr. August Kübler. *With Illustrations.*

Austria—Tirol. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 27–54. **Löwl.**
Rund um den Grossglockner. Von Ferdinand Löwl. *With Illustrations.*

Austrian Alps. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 361–396. **Forcher-Mayr.**
Die Rosengartengruppe. II. Sheil. Von Hans Forcher-Mayr. *With Illustrations and Map.*

Austrian Alps. *Z. Deutsch. u. Österreich. Alpenv.* **29** (1898): 236–269. **Kordon.**
Die Hafnergruppe. Von Frido Kordon. *With Illustrations.*

The Hafner group is part of the High Tauern.

Belgium. *B.S.R. Belge G.* **22** (1898): 345–375, 433–466; **23** (1899): 34–64. **Lenoir.**
Histoire de la commune de Gérouville. Par l'Abbé N.-J. Lenoir. *With Map.*

Belgium—Bruges. *B.S.G. Lille* 31 (1899): 26–52, 107–136, 207–218. **Pigache.**
Les Excursions de la Société de Géographie de Lille en 1898. V. Pigache.—Bruges, sa procession et les travaux du port de Heyst. *Plans.*

Describes the new maritime canal of Bruges.

Denmark—Meteorology. ———
Meteorologisk Aarbog for 1894. Udgivet af det danske meteorologiske Institut. Anden Del. Kjøbenhavn, 1898. Size 14 × 9½, pp. 92.
Ditto, 1896. Første Del. Kjøbenhavn, 1897. Size 14 × 9½, pp. vi. and 138. *Presented by the Danish Meteorological Institute.*

Europe—Prehistoric People. *G.Z.* 4 (1898): 369–388. **Hirt.**
Die vorgeschichtliche Kultur Europas und der Indogermanen. Von H. Hirt.

France. **Baedeker.**
Northern France from Belgium and the English Channel to the Loire, excluding Paris and its Environs. Handbook for Travellers by Karl Baedeker. Third edition. With 10 Maps and 34 Plans. Leipsic: Karl Baedeker; London: Dulau & Co. 1899. Size 6½ × 4½, pp. xxxvi. and 424. *Price 7s. Presented by Messrs. Dulau & Co.*

This new edition is revised with special reference, among other things, to the increasing attention paid to the north of France by cyclists.

France. *Rev. Scientifique* 11 (1899): 417–425, 453–465. **Bertillon.**
De la dépopulation de la France et des remèdes à y apporter. Par M. Jacques Bertillon.

France. **Corcelle.**
Géographie militaire du département de l'Ain. Par J. Corcelle. Size 8½ × 5½, pp. 12. *Presented by the Author.*

France. *B.S.G. Com. Bordeaux* 22 (1899): 1–11. **Duffart.**
Topographie ancienne et moderne des lacs de Cazaux et de Parentis-en-Born. Par Ch. Duffart. *With Map.*

Describes the origin and changes within historic times of lakes on the coast of the Bay of Biscay, formed by the separation of deep estuaries from the sea by the growth of sand-bars and sand-dunes.

France. *J. School G.* 3 (1899): 84–89. **Jefferson.**
Cæsar and the Central Plateau of France. By M. S. W. Jefferson. *With Map.*

France. **Lee.**
Trade of France for the year 1897. Foreign Office, Annual, No. 2199, 1899. Size 10 × 6, pp. 32. *Price 2d.*

France. *Ann. G.* 8 (1899): 117–126. **Roman.**
Structure orographique et géologique du Bas-Languedoc entre l'Hérault et le Vidourle. Par M. F. Roman.

France—Historical. *Rev. G.* 44 (1899): 218–225. **Fauvel.**
Vieux terriers, vieux cadastres.

On the old plans and statistical tables relating to land to be found in France.

France—Normandy. *A travers le Monde, Tour du Monde* 5 (1899): 105–108. ———
Transformations de la Baie du Mont St. Michel. *With Maps and Illustration.*

France—Normandy. *A travers le Monde, Tour du Monde* 5 (1899): 81–84. **Porcher.**
Un Coin de la France—Gacé. Par M. J. Porcher. *With Illustrations.*

The region about Gacé is termed a "veritable miniature Switzerland."

France—Paris. **Conty.**
Conty's Practical Guides. English and American Edition. Pocket Guide to Paris. Paris: Conty's Guides Office [London: Dulau & Co.], [not dated]. Size 6 × 4, pp. 336. *Plans and Illustrations. Presented by the Publishers.*

A compact and comprehensive guide-book.

France—Paris Basin. *Ann. G.* 8 (1899): 110–116. **Barré.**
Quelques observations sur la Région Parisienne orientale, par M. O. Barré. *With Map.*

M. Barré deals as an engineer officer with the peculiar topography of the region east of Paris resulting from its geological structure.

San Marino. *L'Universo* 9 (1899): 42–46. **Franciosi.**
Della Repubblica di San Marino del Dott. Pietro Franciosi. *With Illustrations.*

San Marino. *L'Universo* 9 (1899): 2–4. ——
Nella Repubblica di San Marino.

Scandinavia. *Geolog. Mag* 6 (1899): 4–13. **Howorth.**
The Scandinavian Ice-sheet and the Baltic Glacier: a Sceptical Commentary. By Sir Henry H. Howorth, K.C.I.E., etc. *With Illustration.*

Spain—Balearic Islands. *B.S.G. Madrid* 40 (1898): 220–259. **Martel.**
Exploraciones espeleológicas de D. Eduardo Alfredo Martel en Baleares y Cataluña. Traducción y notas de D. Gabriel Puig y Larraz. *With Plans and Illustrations.*

Switzerland. *Globus* 75 (1899): 137–143. **Zemmrich.**
Deutsches und französisches Volkstum in der Schweiz. Von Dr. J. Zemmrich. *With Map.*

The map shows the much greater homogeneity of the German-speaking than of the French-speaking population of Switzerland.

Switzerland—Historical. ——
Neujahrsblatt herausgegeben von der Stadtbibliothek in Zürich auf das Jahr 1890. Johannes Stumpf's Lobsprüche auf die dreizehn Orte, nebst einem Beitrag zu seiner Biographie (pp. 16, *facsimiles*).
Ditto auf das Jahr 1899. Der "Ueberfall von Nidwalden" (9 September, 1798), bearbeitet nach ältern handschriftlichen Aufzeichnungen von Dr. Conrad Escher. Zürich. Size 12½ × 9½, pp. 52. *Illustrations. Presented by the Secretary of the Stadtbibliothek, Zurich.*

Turkey. ——
Trade of Constantinople, Scutari, and Durazzo. Foreign Office, Annual No. 2196, 1898. Size 10 × 6½, pp. 40. *Price 2½d.*

Turkey. **Revel.**
I commerci della Macedonia coll' Italia. Rapporto del nob. cav. V. Thaon di Revel. (Bollettino del Ministero degli Affari Esteri. Ottobre, 1898.) Roma, 1898. Size 9 × 6½, pp. 40.

Turkey—Macedonia. *Die Natur* 47 (1898): 481–484. **Struck.**
Die macedonische Ebene. Von Ad. Struck.

United Kingdom—Gazetteer. **Cassell.**
Cassell's Gazetteer of Great Britain and Ireland. A Complete Topographical Dictionary of the United Kingdom. With numerous Illustrations and Sixty Maps. [Vol. vi.] Somersham—Zoze Point. London: Cassell & Co., 1898. Size 10½ × 7½, pp. vi. and 472. *Presented by the Publishers.*

This important Gazetteer is now completed in six handsome volumes. The articles are well proportioned and conveniently arranged for easy reference, while considerable skill is shown in the selection of illustrations. One drawback is that the work is anonymous; neither editor nor contributor is acknowledged, and references to the sources of information, which would much assist the student, are not given. Still, for ordinary purposes of reference, the work appears fully satisfactory.

United Kingdom—North Wales. **Baddeley and Ward.**
Thorough Guide Series. North Wales (Part I.) Chester, Rhyl, Llandudno, Bangor, Llanrwst, Bettws-y-Coed, Carnarvon, Llanberis, Beddgelert, Ffestiniog, and Criccieth Sections. By M. J. B. Baddeley, B.A., and C. S. Ward, M.A. Sixteen Maps and Plans and Three Panoramas. By Bartholomew. Sixth Edition—Revised. London: Dulau & Co., 1899. Size 6½ × 4½, pp. xxiv. and 238. *Price 3s. Presented by the Publishers.*

ASIA.

Afghanistan. *Rev. Scientifique* 11 (1899): 529–532. **Winnicki.**
Vers les Indes. Par M. J. Winnicki.

Discusses the political position of Afghanistan as a buffer-state.

Central Asia. **Palacký.**
Zur Flora von Centralasien. Von Prof. Dr. J. Palacký. (Separat-Abdruck aus der "Oesterr. botan. Zeitschrift," Jahrgang 1897, Nr. 10 u. 11.) Size 9 × 6, pp. 12.

Ceylon. **Leclercq.**

Les temples souterrains de Ceylan. Par Jules Leclercq. Lecture faite dans la séance publique de la Classe des lettres de l'Académie royale de Belgique, le 11 mai 1898. (Extrait des Bull. de l'Acad. roy. de Belgique, 3^e sér., t. xxxv., No. 5, pp. 729–738, 1898.) Size 9 × 6. *Presented by the Author.*

China. *Mouvement G.* **16** (1899): 186–187. ——

L'emprunt chinois et le chemin de fer de Peking à Hankow. *With Map.*

China. *C. Rd. S.G. Paris* (1898): 349–351. ——

Mission lyonnaise d'exploration commerciale en Chine. *With Profiles.*

China. *C. Rd. S.G. Paris* (1899): 33–37. **Bonin.**

Empire chinois. Mission Bonin. *With Map and Illustrations.*

China. **Douglas.**

China. By Prof. Robert K. Douglas. London: T. Fisher Unwin, 1899. Size 8 × 5½, pp. xx. and 456. *With Map and Illustrations. Price 5s. Presented by the Publisher.*

Leaving the ancient history of China for another volume, Prof. Douglas has outlined the chief events since the time of Marco Polo, thus giving a concise review of the tendency of Chinese policy and empire down to the present day.

China. *Ann. G.* **8** (1899): 172–175. **Havret.**

Les travaux géographiques des Jésuites en Chine. Par le P. H. Havret.

China. *Church Missionary Intelligencer* **50** (1899): 89–97. **Sell.**

Islam in China. By the Rev. E. Sell.

On the distribution of Mahommedans in China.

China—Lighthouses. *Questions Dipl. et Colon.* **6** (1899): 458–464. **Fauvel.**

Les Phares de la Chine. Par A. A. Fauvel.

The author describes one of the original Chinese lighthouses illuminated by a rush-light in a paper lantern, and then gives an account of the splendid lights now established by the Imperial Customs.

China—Ningpo. **Playfair.**

Trade of Ningpo for the year 1898. Foreign Office, Annual No. 2215, 1899. Size 10 × 6½, pp. 10. *Price* 1*d.*

Chinese Empire. *B.S.G. Paris* **19** (1898): 389–403. **Bonin.**

Note sur les résultats géographiques de la mission accomplie au Tibet et en Mongolie en 1895–1896. Par Charles Eudes Bonin. *With Maps.*

Chinese Empire—Eastern Turkestan. **Vambéry.**
Oester. Monats. Orient **25** (1899): 13–14.

Ethnographisches aus Ostturkestan. Von H. Vambéry.

Eastern Asia. *Ann. Hydrographie* **27** (1899): 97–99. ——

Aus den Reiseberichten Seiner Majestät Schiffe. *With Plate.*

Observations on various harbours in the Philippine Islands, and a series of soundings off the mouth of the Yang-tse-kiang printed on transparent paper, so that it can be laid over the British Admiralty Chart of the district.

French Indo-China. *B.S.G. Rochefort* **20** (1898): 266–277. **Lhomme.**

De Phu-Long-Thuong à Lang-Son. Le chemin de fer et le Song-Thuong. Par le Capitaine Lhomme. *With Map.*

French Indo-China. *Rev. Maritime* **140** (1899): 474–507. **Mercié.**

Exploration en Annam et au Laos. Par M. E. Mercié. *With Maps.*

Report of a journey from Hué across Annam to Kémarat on the Mekong, with detailed itineraries and route-maps.

Historical. *Deutsche G. Blätter* **22** (1899): 33–37. **Meldau.**

Bemerkungen zum "Indischen Seespiegel Mohît." Von Dr. Meldau.

Historical—Gastaldi. *Ymer* **19** (1899): 33–43. **Nordenskiöld.**

Om det inflytande Marco Polos reseberättelse utöfvat på Gastaldis kartor öfver Asien. Af A. E. Nordenskiöld.

On the influence exerted by the records of Marco Polo's travels on the maps of Asia drawn by Gastaldi in the sixteenth century.

GEOGRAPHICAL LITERATURE OF THE MONTH.

India. **Murray.**
A Handbook for Travellers in India, Burma, and Ceylon, including the Provinces of Bengal, Bombay, and Madras, the Punjab, North-West Provinces, Rajputana, Central Provinces, Mysore, etc.; the Native States, Assam, and Cashmere. Third Edition. With Seventy-four Maps and Plans. London: John Murray, 1898. Size 7 × 5, pp. xc. and 484. *Price 20s. Presented by the Publisher.*

This handbook serves as more than a guide-book to India. The number of well-selected and clearly-produced maps, and the effort which has been made to arrive at a serviceable and intelligible spelling of place-names, give it a special value to the geographical student.

India—Pilot. **Taylor.**
The West Coast of Hindustan Pilot, including the Gulf of Manar, the Maldive, and Laccadive islands. Originally compiled by Commander A. D. Taylor, late Indian Navy. Fourth Edition. London: J. D. Potter, 1898. Size 9½ × 6, pp. xxii. and 378. *Index Chart. Price 4s. Presented by the Hydrographer, Admiralty.*

India—Punjab. ———
Gazetteer of the Dera Ghazi Khan District. Revised Edition, 1883–84. Compiled and published by Authority of the Punjab Government. Lahore, 1898. Size 10 × 7, pp. xii., 194, and lvi. *Map and Plans. Presented by the India Office.*

India and China. *Bijd. Taal-, Land- en Volkenk. Ned.-Indië* 6 (1899): 87–95. **Vogel.**
Gegevens betreffende eene handelsverbinding tusschen Indië en China over Tibet gedurende de oudheid. Door Dr. J. Ph. Vogel.

On the existence of commercial relations between India and China by way of Tibet in ancient times.

Indo-China. **Pavie.**
Mission Pavie Indo-Chine, 1879–95. Études diverses. II. Recherches sur l'Histoire du Cambodge, du Laos et du Siam. Par Auguste Pavie. Contenant la transcription et la traduction des Inscriptions. Par M. Schmitt. Paris: E. Leroux, 1898. Size 11½ × 9, pp. xlvi. and 490. *Map and Illustrations.*

Indo-China. *Questions Dipl. et Colon* 6 (1899): 4–6. **Pensa.**
Les Chemins de fer de l'Indo-Chine. Par H. Pensa.

Japan—Historical. *M. Deutsch. Ges. Natur- u. Völkerk. Ostasiens* 7 (1898): 1–52. **Riess.**
Die Ursachen der Vertreibung der Portugiesen aus Japan (1614–1639). Von Dr. Ludwig Riess.

Malay Archipelago—Borneo. **Nieuwenhuis.**
Tijds. Indische Taal-, Land- en Volkenk. 40 (1898): 508–541.
La récente expédition scientifique dans l'île de Bornéo, conférence du Dr. A. W. Nieuwenhuis.

This journey is noticed in the *Journal*, p. 532.

Malay Archipelago—Historical. **Van der Kemp.**
Bijd. Taal-, Land- en Volkenk. Ned.-Indië 6 (1899): 1–58.
Raffles' bezetting van de Lampongs in 1818. Door P. H. van der Kemp.

Malay Archipelago—Java. **Bosboom.**
Tijds. Indische Taal-, Land- en Volkenk. 40 (1898): 542-570.
Oude woningen in de stad Batavia. Door H. D. H. Bosboom. *With Plates.*

Malay Archipelago—Philippines. **Coronas.**
Observatorio de Manila. La Erupción del Volcán Mayón en los días 25 y 26 de Junio de 1897. Por el P. José Coronas S. J. Manila, 1898. Size 12½ × 9, pp. 58. *Maps and Plates.*

On the eruption of the volcano of Mayon in June, 1897, with coloured illustrations and maps.

Persia—Trade Routes. *J.S. Arts* 47 (1899): 341-359. **Hotz.**
Persian Trade Routes. By A. Hotz. *With Map.*

Philippine Islands. *Ann. Hydrographiques* (1898): 48–56. **Grenet.**
Signes précurseurs des cyclones dans l'archipel des Philippines. Par M. Victor Grenet.

On the forecasting of cyclones in the Philippines.

Russia—Caucasus. ———
Beobachtungen des Tiflisser Physikalischen Observatoriums im Jahre 1896. Tiflis, 1898. Size 13½ × 10, pp. xxxii. and 196.

Russia—Trans-Caucasus. **Stevens.**
Agriculture in the Trans-Caucasus for the Year 1898. Foreign Office, Annual No. 2198, 1899. Size 10 × 6½, pp. 14. *Price* 1*d.*

Siberian Railway. *J.R. United Service I.* **43** (1899): 61–66. **Beresford.**
The Trans-Siberian Railway. By Lieut.-Colonel C. E. de la Poer Beresford.

On the present position of the great railway.

Straits Settlements. ———
Straits Settlements. Reports on the Federated Malay States for 1897. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. 76. *Price* 8½*d.*

AFRICA.

Abyssinia. *B.S.G. Paris* **19** (1898): 404–431. **Bonchamps.**
Une mission vers le Nil Blanc. Par C. de Bonchamps. *With Map and Illustrations.*

Africa—Exploration. *G.Z.* **4** (1898): 388–397, 574–588, 643–653, 694–710. **Schenck.**
Die Afrikaforschung seit dem Jahre 1884 und ihr gegenwärtiger Stand. Von Dr. Adolf Schenck. I. Die deutschen Kolonien.

Africa—Historical. **Azurara.**
The Chronicle of the Discovery and Conquest of Guinea. Written by Gomes de Azurara; now first done into English by Charles Raymond Beazley and Edgar Prestage. Vol. ii. (Chapters xli.–xcvii.). With an Introduction on the Early History of African Exploration, Cartography, etc. London: Printed for the Hakluyt Society, 1899. Size 9 × 6, pp. cl. and 129–362. *Plates. Presented by the Hakluyt Society.*

The first volume of this translation was published by the Hakluyt Society in 1896, and the work is now completed.

Africa—North-Eastern. *Miss. Catholiques* **31** (1899): 179–180. **Vuillot.**
Carte des Missions Catholiques du Nord-Est Africain et du Soudan Egyptien. Par M. Paul Vuillot. *With Map.*

Africa—Railways. *Rev. Scientifique* **11** (1899): 321–335. **Grosclaude.**
Les nouveaux chemins de fer africains. Par M. Étienne Grosclaude. *With Map.*

Algeria. *Ann. G.* **8** (1899): 141–159. **Blayac.**
Le pays des Memenchas à l'Est des monts Aurès (Algérie). Par M. J. Blayac. *With Maps.*

Algeria. *Tour du Monde* **5** (1899): 97–120. **Huguet and Peltier.**
Le Sud de la Province d'Alger (El Goléa et les Trois Forts.) Par MM. le Dr. Huguet et le Lieut. Peltier. *With Illustrations.*

Algeria and Tunis. **Leroy-Beaulieu.**
L'Algérie et la Tunisie. Par Paul Leroy-Beaulieu. Deuxième Édition. Paris: Guillaumin et Cie., 1897. Size 9 × 6, pp. xiv. and 620. *Price* 9 *francs.*

British Central Africa—Postal Guide. ———
British Central Africa Postal Guide. No. 1. 1st January, 1899. Printed and Published at the Blantyre Mission Press. Size 8 × 5½, pp. 66. *Presented by Alfred Sharpe, Esq., C.B.*

British East Africa. **Hardinge.**
Africa. No. 3 (1899). Report by Sir A. Hardinge on the British East Africa Protectorate for the Year 1897–98. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 30. *Price* 3½*d.*

This Report is summarized on p. 659.

Cape Colony. *P.I. Civil Engineers* **135** (1899): 178–183. **Stewart.**
Trial Survey for a Railway over the Outeniqua Mountains, Cape Colony. By C. E. Stewart.

Congo Districts. *Mouvement G.* **16** (1899): 211–215. **Puttkamer.**
Le Voyage de M. Puttkamer, gouverneur du Kamerun, au Stanley Pool et dans la Sanga.

Congo Railway. *P.I. Civil Engineers* **135** (1899): 184–197. **Trouet.**
The Congo Railway. By Léon Trouet. *With Map.*

Congo State. *Mouvement G.* **16** (1899): 145–148. ———
L'accord Anglo-Français et l'Etat du Congo. *With Map.*

Congo State. *Mouvement G.* **16** (1899): 61–64. **Glorie.**
L'expédition Glorie de Riba-Riba au lac Kivu. *With Map.*

Congo State. *Oester. Monats. Orient.* **25** (1899): 14–16. **Maurig.**
Das Congogebiet vom wirthschaftlichen Standpunkte. Von E. v. Maurig.

A sketch of the resources of the Congo State *à propos* of the opening of the Congo railway.

Congo State. *B.S.R. Belge G.* **23** (1899): 8–33. **Verhaegen.**
Impressions Congolaiçes. Par Pierre Verhaegen.

The impressions were derived during a visit at the time of the opening of the Congo railway.

Congo State. *Mouvement G.* **16** (1899): 73–77. **[Wauters.]**
La révolte des Batetela. *With Map.*

East Africa. **Wickenburg.**
Wanderungen in Ost-Afrika. Von Eduard Grafen Wickenburg. Wien: Gerold & Cie., 1899. Size 10½ × 7½, pp. xx. and 440. *Portrait, Maps, and Illustrations. Presented by the Author.*

Count Wickenburg in 1897–98 made a sporting tour in Somaliland, going inland from Zeila and from Berbera, and finally from a point on the Mombasa railway he followed up the Tsavo river to the northern slopes of Kilimanjaro.

Madagascar—Economic Plants. *Antananarivo Annual* **6** (1898): 218–223. **Baron.**
Notes on the Economic Plants of Madagascar. By Rev. R. Baron.

Madagascar—Historical *Antananarivo Annual* **6** (1898): 241–244. ———
Early Notices of Madagascar from the Old Voyagers, Part vii.

An account of the visit to Madagascar of H.M.S. *Kent* in 1754.

Madagascar—Place-Names. **Sibree and Price.**
Antananarivo Annual **6** (1898): 152–166.
Malagasy Place-Names: Part ii. (conclusion).

Madeira and Canary Islands. **Brown.**
Madeira and the Canary islands. A Practical and Complete Guide for the use of Invalids and Tourists, with Sixteen Coloured Maps and Plans and numerous Sectional and other Diagrams. By A. Samler Brown. Fifth and Revised Edition. London: Low & Co., 1898. Size 7½ × 5, pp. xviii. and 346. *Price* 2*s.* 6*d. Presented by the Publishers.*

This edition is improved by the addition of sections on the circulation of the atmosphere in the trade-wind zone, and on the geology of the islands. The more practical information is brought up to date.

Marocco. *Questions Dipl. et Colon.* **5** (1898): 385–393. **Etienne.**
La France et le *Statu quo* Marocain. Par E. Étienne.

Marocco. *Fortnightly Rev.* **65** (1899): 381–389. **Spilsbury.**
The "Tourmaline" Expedition and the opening of the Sus. By Major A. Gybbon Spilsbury.

Niger Coast Protectorate. ———
Africa. No. 2, 1899. Annual Report on the Niger Coast Protectorate for the year 1897–98. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 26. *Price* 3*d.*

Nigeria—Borgu. *Blackwood's Mag.* **165** (1899): 605–620. ———
An unwritten chapter of history. The Struggle for Borgu. *With Map.*

Sahara. *Rev. Française* **24** (1899): 210–214. **Foureau and Lamy.**
Sahara: La marche de la mission Foureau-Lamy.—II.

This is noticed in the *Journal*, p. 533.

Sahara. *Rev. Scientifique* **11** (1899): 269–275. **Souleyre.**
Les ressources minières du Sahara. Par M. A. Souleyre.

South Africa. *Natural Science* **14** (1899): 199–202. **Jones.**
The Great Glacial Moraine of Permian Age in South Africa. By Prof. T. Rupert Jones, F.R.S. *With Sketch-Map.*

South Africa. *Verh. Ges. Erdk. Berlin* 25 (1898): 513–517. **Passarge.**
Herr Dr. S. Passarge über seine Reisen in Süd-Afrika.

This is referred to on p. 661.

Tunisia. *Rev. G.* 44 (1899): 122–133. **Vassel.**
Le chemin de fer de Bizerte au Kef et á la vallée du Sarrath. Par Eusebe Vassel.

M. Vassel strongly urges the construction of a railway from Bizerta to connect with the Algerian railway system for strategic purposes, and in order to serve as an outlet for the valuable deposits of phosphates which occur in the interior.

Uganda. ———
Africa. No. 1 (1899). Papers relating to Recent Events in the Uganda Protectorate. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 52. *Price 5½d.*

Uganda. *Globus* 74 (1898); 389–392. **Förster.**
Die Zustände in Uganda, 1897–98. Von Brix Förster. *With Illustrations.*

Notes on recent occurrences in Uganda. The illustrations include a facsimile letter of King Mwanga's.

NORTH AMERICA.

United States—Arizona. **Fewkes.**
Preliminary Account of an Expedition to the Pueblo Ruins near Winslow, Arizona, in 1896. By J. Walter Fewkes.—Annual Report of the Smithsonian Institute, 1896, pp. 517–539. *Plates.* Washington, 1898.

An original paper describing the work of an expedition sent out by the Bureau of American Biology in 1896.

United States—California. *J. Geology* 6 (1898): 776–786. **Smith.**
Geographic Relations of the Trias of California. By James Perrin Smith.

United States—Connecticut. **Davis.**
Department of the Interior—U.S. Geological Survey. The Triassic Formation of Connecticut. By William M. Davis. Extract from the Eighteenth Annual Report of the Survey, 1896–97. Part ii.—Papers chiefly of a theoretic nature. Washington, 1898. Size 12 × 8, pp. 192. *Map, Sections, and Illustrations.*

A richly illustrated memoir on the Triassic formation of Connecticut, with a geological map and sections.

United States—Maryland. ———
Maryland Geological Survey. Volume Two. Baltimore: the Johns Hopkins Press, 1898. Size 10½ × 7½, pp. 510. *Maps and Plates. Presented by the Maryland Geological Survey.*

This report deals with the general work of the Maryland Geological Survey, with the Building Stones of the State, and in a special way with the Cartography of Maryland, existing and in progress, by Mr. Henry Gannet and Mr. Edward B. Mathews, a note on which appears in the *Journal*, p. 537.

United States—Mississippi River. *J. Geology* 7 (1899): 1–22. **Leverett.**
The Lower Rapids of the Mississippi River. By Frank Leverett. *With Sketch-Map.*

United States—New Mexico. *Globus* 75 (1899): 155–159. **Hodge.**
Die Erforschung der verzauberten Mesa (La Mesa encantada) durch F. W. Hodge. *With Illustrations.*

United States—New York. *J. Geology* 6 (1898): 771–775. **Gilbert.**
Bowlder-Pavement at Wilson, N.Y. By G. K. Gilbert.

United States—Texas. **Nugent.**
Trade of Texas for the year 1898. Foreign Office, Annual No. 2210, 1899. Size 10 × 6, pp. 40. *Price 2½d.*

United States—Wheat. **Atkinson.**
The Wheat-Growing Capacity of the United States. By Edward Atkinson. Reprinted from Appleton's *Popular Science Monthly* for December, 1898. Size 9½ × 6½, pp. 18. *Presented by the Author.*

A criticism of Sir William Crookes' address on the wheat-supply of the world, pointing out that the resources of the United States are much larger than has been supposed.

United States—Wisconsin. *J. Geology* 7 (1899): 79–82. **Squier.**
Studies in the Driftless Region of Wisconsin. By G. H. Squier.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Laing.**
Trade of the Argentine Republic for the Year 1898. Foreign Office, Annual No. 2219, 1899. Size 10 × 6½, pp. 30. *Price 2d.*

Argentine Republic—Census. ——
Segundo Censo de la República Argentina Mayo 10 de 1895. Tomo i. Territorio; Tomo iii. Censos Complementarios. Buenos Aires, 1898. Size 14½ × 10½, pp. (i.) xxiv. and 642; (iii.) cclvi. and 492. *Maps and Illustrations. Presented by the Census Commission.*

Argentine Republic and Chile. ——
Records of the Proceedings of the Argentine and Chilian Experts concerning the Demarcation of the Boundary-line between the Argentine Republic and Chili. Buenos Aires, 1898. Size 10½ × 7½, pp. 48. *Presented by Dr. Francisco Moreno.*

Argentine Republic and Chile. **Lamarca.**
Translation of the Boundary Agreements in force between the Argentine Republic and Chili. By Dr. Emilio Lamarca. Buenos Aires, 1898. Size 11 × 7½, pp. 64. *Presented by Dr. Francisco Moreno.*

Argentine Republic and Chile. **Lamarca.**
Boundary Agreements in Force between the Argentine Republic and Chili. By Dr. Emilio Lamarca. Buenos Aires, 1898. Size 10½ × 7½, pp. xlvi. and 112. *Maps. Presented by Colonel G. E. Church.*

Brazil. *Kolon. Jahrb.* **11** (1898): 177–211. ——
Deutsche Kolonisation in Brasilien.

Brazil. **Canstatt.**
Das Republikanische Brasilien in Vergangenheit und Gegenwart. Nach den neuesten amtlichen Quellen und auf Grund eigener Anschauung von Oskar Canstatt. Leipzig: F. Hirt & Sohn, 1899. Size 9½ × 6½, pp. 656. *Maps and Illustrations. Price* 12 marks.

This work is largely concerned with the economic geography of Brazil, and contains recent statistics.

Central America—Canal. *J.R. United Service I.* **43** (1899): 67–72. **Levita.**
The Inter-Oceanic Canal. By Captain Cecil B. Levita. *With Map.*

On the Clayton-Bulwer treaty and the present political position as regards a canal between the Atlantic and Pacific.

Central America—Canal Routes. **Hurst.**
Isthmus of Panama, Nicaragua, Canal Routes, etc. Compiled by Thomas Wright Hurst, 1898. Size 12 × 9, pp. 98. *Maps. Presented by the Author.*

Suggestions for a canal across the Isthmus of Darien from Caledonia bay on the Atlantic side to the Gulf of San Miguel on the Pacific, with notes on other projects.

Cuba. **Clark.**
Commercial Cuba. A Book for Business Men. By William J. Clark. With an Introduction by E. Sherman Gould. London: Chapman & Hall, 1899. Size 9½ × 6¼, pp. xviii. and 514. *Maps, Plans, and Illustrations. Price* 14s.

Ecuador. **Stübel.**
Die Vulkanberge von Ecuador, geologisch-topographisch Aufgenommen und Beschrieben. Von Alphons Stübel. Berlin: A. Asher & Co., 1897. Size 13 × 10, pp. xxii. and 556. *Map.*

Guatemala—Copan. *B. American G.S.* **31** (1899): 39–50. **Gordon.**
The Ruined City of Copan. By George Byron Gordon.

Jamaica. **Roxburgh and Ford.**
The Handbook of Jamaica for 1899: comprising Historical, Statistical, and General Information concerning the Island. Compiled . . . by T. L. Roxburgh and Jos. C. Ford. London: E. Stanford, 1899. Size 8½ × 6. pp. viii. and 560. *Map. Price* 7s. 6d. *Presented by the Publisher.*

Mosquito Coast. *Blackwood's Mag.* **165** (1898): 868–883. ——
A forgotten Puritan Colony.

Recalls the attempt at colonization of the Mosquito coast between 1630 and 1641.

Nicaragua. *Globus* **75** (1899): 201–208, 222–227. **Sapper.**
Das nicaraguensische Erdbeben vom 29 April 1898 und die Maribios-Vulkane. Von Dr. Karl Sapper. *With Map and Illustrations.*

Peru. *B.S.G. Lima* **7** (1898): 410-440. **Montferrier.**

Colonización del Norte del Perú. Por el ingeniero A. de Montferrier.

Peru. *B.S.G. Lima* **7** (1898): 349-405. **Raimondi.**

Itinerario de los viajes de Raimondi en el Perú: Lampa, Azángaro, Huancané, Putina, Orurillo, Santa Rosa, Sicuani, Checcacupe, Cuzco (1865).

Peru. **René-Moreno.**

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Hawaiian Ethnography. By Titus Munson Coan.

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Queensland's Progress. By the Hon. Sir Horace Tozer, K.C.M.G.

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Sur les nouvelles et importantes applications faites au Canada de la méthode du lever des plans à l'aide de la Photographie. Note de M. A. Laussedat.

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On the calculation of the radius of vision from a given elevation above sea-level. The memoir deals with the calculation of the geometrical radius of vision, the actual radius taking account of refraction, and of the extreme distances taking into account the height of the object looked at, and of the area of the Earth's surface visible from various elevations.

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Documents sur l'heure décimale de la Convention nationale. Par M. J. de Rey-Pailhade.

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Moyennes des hauteurs barométriques, en soleil austral, aux différents points du demi-méridien boréal du Soleil. Écarts dus aux révolutions synodique et tropique de la Lune. Note de M. A. Poincaré.

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The German Deep-Sea Expedition. *With Chart.*

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Cristobal Colón ¿ espanol?—Conferencía. Por D. Celso Garcia de la Riega.

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Notice biographique sur Christian Garnier (1872–1898). Par L. Drapeyron. *With Portrait and Illustration.*

Christian Garnier died at the age of twenty-six, after having devoted his attention from infancy almost exclusively to the study of geography.

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A la mémoire de Jacques Gebelin (1848–1898). Par M. J. Manès. *With Portrait.*

M. Gebelin did much, by lecturing and writing, to develop popular interest in geography, and under his editorship the *Bulletin* of the Bordeaux Society of Commercial Geography kept a high place amongst the publications of geographical societies.

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B.S.G. Madrid 40 (1898): 1–32 and 1–24.

El Dr. D. Marcos Jiménez de la Espada, naturalista, geógrafo é historiador. Por D. Cesáreo Fernández Duro. *With Portrait.*

El Dr. D. Marcos Jiménez de la Espada, zoólogo y viajero naturalista. Por D. Francisco de Paula Martinez y Sáez.

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Famous Travellers of To-day. Lieut. Peary, U.S.N. *With Portrait.*

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The Relative Growth of the Component Parts of the Empire. By Sir Robert Giffen, K.C.B., F.R.S.

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Colonial Systems of the World. By O. P. Austin.

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Starting with the remarkable statement that "all phenomena within our ken, whether they have to do with Man or Nature, may be classed under some aspect of the many-sided and comprehensive science of Geography," this little elementary school-book proceeds to outline some useful lessons on observations of common things.

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Physical Geography in High Schools. By Joseph H. Perry.

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Ancora sul materiale scholastico per l'insegnamento della Geografia e più specialmente sui Plastici topografici del Prof. Pietro Sensini.

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Leçon d'ouverture du cours de géographie. Par M. P. Vidal de la Blache.

The opening address of the course of geography at the Faculty of Letters in Paris. It touches on the work of the lecturer's predecessor, M. Himly, and on the recent progress of geography.

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The Travels of Ibn Batuta, in Urdu. Vol. ii. Containing a Description of his Travels in India, Maldives, Ceylon, Sumatra, Siam, China, Spain, and Negroland. Translated from the Original Arabic of Ibn Jazzi of Granada. With copious Notes, illustrative of the History, Geography, Archæology, Botany, Mineralogy, etc., of those countries. By "Khan Sahib" Maulvi Muhammad Husain, M.A. Lahore: Punjab Central Publishing House, 1898. Size 10 × 6½. *Maps, Plans, etc. Presented by Maulvi Muhammad Husain.*

Money, Weights, and Measures. **Browne.**

The Money, Weights, and Measures of the chief Commercial Nations in the World, with the British Equivalents. An Abridgment of 'The Merchants' Handbook of Money, Weights, and Measures.' By W. A. Browne, M.A., LL.D. Eighth Edition. London: E. Stanford, 1899. Size 7 × 4½, pp. xiv. and 200. *Price* 2*s.* 6*d. Presented by the Author.*

Mediterranean Winter Resorts. **Reynolds-Ball.**

Mediterranean Winter Resorts. A Practical Handbook to the principal Health and Pleasure Resorts on the Shores of the Mediterranean. With special articles on the principal Invalid Stations by resident English Physicians. By Eustace A. Reynolds-Ball. Vol. i. South Europe. Vol. ii. North Africa and Mediterranean Islands. Fourth Edition (rewritten and enlarged). London: Paul & Co., 1899. Size 7 × 4½, pp. 537. *Maps and Diagrams. Price (each vol.)* 3*s.* 6*d. Presented by the Publishers.*

This guide-book has been rewritten and enlarged; the division into two volumes makes the work more convenient for most tourists.

Missionary Report. ——

Eighty-eighth Annual Report of the American Board of Commissioners for Foreign Missions. Presented at the Meeting held at Grand Rapids, Mich., October 4–7, 1898. Boston: Published by the Board. Size 9½ × 6½, pp. xxviii., 160, and 26.

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Das Ende der spanischen Colonialmacht. *With Map.*

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The Statesman's Year-Book. Statistical and Historical Annual of the States of the World for the year 1899. Edited by J. Scott Keltie, LL.D., with the assistance of I. P. A. Renwick, M.A., LL.B. London: Macmillan & Co., 1899. Size 7½ × 5, pp. xxxii. and 1248. *Maps. Price* 10*s.* 6*d. Presented by the Publishers.*

The issue for 1899, in addition to a very thorough revision, is provided with a series of new tables of the finance and commerce of various countries, and four maps illustrating affairs of current interest. The maps represent the new limits of the mainland extension of Hongkong, Newfoundland, showing the fishing-banks and the limits of the French shore; and two maps of Africa, one giving the railways which are in operation or in construction, and the other showing the telegraph lines.

Statistics. **Mulhall.**

The Dictionary of Statistics. By Michael G. Mulhall. Fourth Edition. Revised to November, 1898. London: G. Routledge & Sons, 1899. Size 10½ × 7½, pp. 854. *Price* 21*s.*

Travel. **Fraser.**

Round the World on a Wheel, being the Narrative of a Bicycle Ride of Nineteen Thousand Two Hundred and Thirty-seven Miles through Seventeen Countries and across Three Continents, by John Foster Fraser, S. Edward Lunn, and F. H. Lowe. Written by John Foster Fraser. London: Methuen & Co., 1899. Size 8 × 5½, pp. xii. and 532. *Illustrations. Price* 6*s. Presented by the Publishers.*

The preface states, "This is a book of travel. But, unlike other books of travel, it is not clever or wise or scientific." It is a slight narrative of a tour on bicycles through Europe, by the Caucasus into Persia, by sea to Karachi, across India, by steamer to Rangoon, across Burma and China, and finally across the United States.

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Bericht über meine Reise nach Westindien und Nordamerika. Von F. Doflein.

Notes of a trip undertaken for the study of the biology of the West Indies.

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Philippine Islands. **Hartleben.**

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British East Africa. **Paulitschke.**

Graf Eduard Wickenburg's Reiserouten in Britisch-Ost-Afrika, 1897–98. Nach den Aufnahmen des Reisenden bearbeitet von Prof. Dr. Ph. Paulitschke. Scale 1 : 500,000 or 7·9 stat. miles to an inch. G. Freytag & Berndt, Wien, 1899. Graf Eduard Wickenburg, Wanderungen in Ost-Afrika. Tafel 2. *Presented by the Publishers.*

Egypt. **Schweinfurth.**

Aufnahmen in der Östlichen Wüste von Ägypten, von Georg Schweinfurth. 1 Serie (10 Blätter). Erste Lieferung. Blatt I. Die Umgegend von Heluan als Beispiel der Wüsten-Denudation, 1895–96. Scale 1 : 30,000 or 0·47 stat. mile to an inch. II. Karte der Gegend zwischen Belbës und Suës. Scale 1 : 200,000 or 3·1 stat. miles to an inch. III. Die Thalsysteme des Uadi Moathil und des Uadi Tarfeh. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Berlin : Dietrich Reimer (Ernst Vohsen), 1899.

These three sheets form the first part of a series of maps constructed from the route surveys and observations made by Dr. Georg Schweinfurth in the eastern desert of Egypt. The first sheet, on an enlarged scale, includes Helwan and the surrounding country, a district that has been specially chosen to illustrate desert denudation, for which purpose it is well suited. Sheet II. shows the desert country between Belbeis and Suez, and is based upon surveys made between the years 1879 and 1886; whilst Sheet III., including the Wadi Moathil and Wadi Tarfeh district, is from surveys made between 1876 and 1887. The maps are clearly drawn, printed in four colours, and contain numerous descriptive notes.

German East Africa. **Kiepert.**

Deutsch-Ostafrika. Scale 1 : 2,000,000 or 31·4 stat. miles to an inch. Von Dr. Richard Kiepert. Berlin : Dietrich Reimer (Ernest Vohsen), 1899.

Somaliland. **Paulitschke.**

Graf Eduard Wickenburg's Reiseroute von Zeila über Harar nach Dschig-Dschiga, April und Juni, 1897. Nach den Aufnahmen des Capitäns H. G. C. Swayne und den Angaben des Reisenden, construirt von Prof. Dr. Philipp Paulitschke. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. G. Freytag & Berndt, Wien, 1899. Graf Eduard Wickenburg, "Wanderungen in Ost-Afrika." Tafel 1. *Presented by the Publishers.*

Somaliland. **Paulitschke.**

Reiseroute des Grafen Eduard Wickenburg im Somållande Juli bis Oktober, 1897. Nach den Aufnahmen des Reisenden bearbeitet von Prof. P. Paulitschke. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Gotha : Justus Perthes. Graf Eduard Wickenburg, "Wanderungen in Ost Afrika." Tafel 1A. *Presented by the Publisher.*

South Africa. **Dickinson.**

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West Africa. **Spicq.**

Carte de la Boucle du Niger, dressée par le Lieutenant Spicq, de l'infanterie de marine, ayant pour base la Carte de M. le Gouverneur Binger et les travaux récents du Commandant Marchand, complétée et mise à jour. Scale 1 : 1,500,000 or 23·6 stat. miles to an inch. Service Géographique des Colonies. Paris, 1898. Maison Andriveau-Goujon. Henry Barrère, Editeur-Géographe. *Presented by M. le Ministre des Colonies, Paris.*

This is a new edition of this map, which was originally published in 1897. It includes the country between the Niger and the West Coast, and has been revised to bring it up to date.

AMERICA.

Klondike. **Tyrrell.**

Map of the Klondike Gold Field and vicinity, including the latest Official Surveys by Departments of Lands and Geological Survey. Scale 1 : 1,506,880 or 8 stat. miles to an inch. J. B. Tyrrell, M.A., F.G.S., Mining Engineer, Dawson City, 1899. *Presented by the Author.*

This map includes the results of the latest official surveys, and will doubtless be useful to those having an interest in the Klondike Gold Fields. It is apparently reduced by photography from a larger map, with the not unusual result that some of the names are too small to be read with ease.

GENERAL.

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World. **Vivien de Saint Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Paris: Librarie Hachette et Cie. Sheet:—Allemagne. *Price 2 fr.*

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Pilot Charts of the North Atlantic and Pacific Oceans for May, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

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